

# THE DENTAL PRACTITIONER

## AND DENTAL RECORD

*Including the Transactions of the British Society for the Study of Orthodontics, and the official reports of the British Society of Periodontology, the Glasgow Odontological Society, the Liverpool and District Odontological Society, the North Staffordshire Society of Dental Surgeons, the Odonto-chirurgical Society of Scotland, and the Dental and Medical Society for the Study of Hypnosis*

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# THE DENTAL PRACTITIONER AND DENTAL RECORD

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## EDITORIAL

### THE HIGH COST OF LEARNING

THE ever-increasing cost of dental text-books is a problem that vexes the teachers in dental schools to-day. The student is able to buy few of the modern standard works with which he should be familiar.

The DENTAL PRACTITIONER felt that the time had arrived for the whole problem to be aired and some possible solution put forward. The situation, if it continues, could prove dangerous for students, dental publishers, and authors alike. Books priced off the bookshelves would be a loss to all.

Unlike students in the other professions, the dental student is expected to provide himself with an expensive kit of equipment as well as with the books. Although much of this is taken care of by grants from one source or another, none the less students are understandably reluctant to "blow" what is left on exceptionally costly reference books.

How can he afford three or four pounds a volume?

Why is this cost of learning so high? Some blame can be laid at the doors of the publishers and the authors: and with the readers as well.

The author, in many cases, writes long definitive texts covering every aspect of his chosen subject. He includes many photographs. The result sometimes involves a book of 500 to 1000 pages.

The publisher in his turn, because sales are not high, frequently treats his dental and medical text-books as prestige publishing.

And the publishers in this field compete with each other in maintaining a very high, and therefore costly, presentation.

Finally the reader, who *does* buy such expensive products, has come to expect and demand this high standard. And by his expectation he hits home the final nail in the coffin of any hopes for cheaper production.

Something must be done. But what?

We believe that if concessions were made by all three interested parties, a very simple solution swiftly becomes obvious: paper-back editions of those standard works which should be in the possession of every undergraduate.

Editorial amendments would naturally need to be made for such editions or, in certain cases, the original work might be conceived with purely paper-back publication in view. The author would reduce the customary length of his manuscript, or he might divide it into two or more books each concentrating on a particular aspect of his subject.

The publisher would use poorer quality paper, even newsprint, with a central section of glossy pages for photographic illustrations. Line drawings could frequently be substituted in the newsprint section for photographs; they are often more explicit anyway. Pages would be glued rather than sewn, a considerably less costly method; the covers would be stiff paper or light cardboard.

Is this not a possible solution to the high cost of learning?

## ADRENALINE

### ITS ROLE IN LOCAL ANÆSTHETIC SOLUTIONS FOR DENTISTRY

By **JAMES M. MUMFORD**, M.Sc., M.S., F.D.S. R.C.S.  
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*Lecturer in Anaesthesia, The University of Liverpool*

ADVERSE systemic effects following the use of local anæsthetic solutions containing adrenaline (epinephrine) have been loosely described as "adrenaline shock". As a result, many dentists are apprehensive of using adrenaline, especially when patients present with a history of cardiovascular disease, hyperthyroidism, or of a fainting attack following previous injection of a local anæsthetic solution.

This paper attempts to clarify the role of adrenaline in local anæsthetic solutions for use in dentistry.

#### ADVANTAGES OF USING ADRENALINE

**1. Increased Potency.**—The potency of a local anæsthetic solution depends upon many factors. One of the most important of these is the ability of the solution when injected to remain localized long enough for sufficient to reach the nerve and interfere with sensory conduction. Acting against this is the absorption of the solution into the general blood-stream, thus reducing the effective dose of local anæsthetic. The more vascular the area the more rapid is the absorption, and this is one reason against injecting a local anæsthetic into an inflamed area. Absorption is also increased if the local anæsthetic produces vasodilatation. Absorption is decreased, and anaesthesia is thereby more likely to occur, if there is vasoconstriction.

Although it has been claimed that some of the newer local anæsthetics act as vasoconstrictors, none are as efficient as cocaine in this respect, and most are potent vasodilators. The result is that, following injection, rapid absorption into the blood-stream occurs, leaving insufficient time for diffusion to the nerve to take place. Anaesthesia is transient, insufficient, or even may not occur at all. The difficulty might be overcome by injecting a

larger dose, but it is better to add adrenaline or another vasoconstrictor to the solution. This decreases the absorption of the local anæsthetic into the general circulation, thus acting as a pharmacological tourniquet. In doing this it does not, however, interfere with local diffusion of the anæsthetic and as a result anaesthesia is more likely to occur, to start more rapidly, to last longer, to be deeper, and to extend over a wider area.

Most dentists will accept the above explanation, but possibly few realize the very marked difference in potency between the local anæsthetic with adrenaline and without it.

In a recent paper by Mumford and Gray (1957) a comparison was made between lignocaine (xylocaine) and carbocaine, without the presence of adrenaline. At one stage, anaesthesia was so poor that the operator thought that sterile saline had been included as a component of the "blind" trial. In fact it was lignocaine; yet when used with adrenaline this is possibly the best local anæsthetic available. Moreover, at the conclusion of the trial it was found that 2.1 ml. of 2 per cent lignocaine without adrenaline resulted in successful anaesthesia in less than half the cases. This result has recently been substantiated by Berling (1958), and the two trials confirm that adrenaline is an important active component in local anæsthetic solutions.

As research continues there might become available a local anæsthetic which, like cocaine, will cause vasoconstriction. At present, the compound carbocaine shows promise in this respect, as can be seen from the results of Mumford and Gray (1957) and Berling (1958) (*Table I*).

Carbocaine is a new local anæsthetic which is said to have vasoconstrictive properties, so it may not need the addition of adrenaline.

In the absence of adrenaline the acidity of the solution could be reduced so that local irritation would be less likely. Carbocaine solutions might also leave less numbness of the lips and cheeks, which would be desirable.

Table I.—PERCENTAGE INCIDENCE OF ANÆSTHESIA USING LIGNOCAINE AND CARBOCAINE WITHOUT ADRENALINE

	BERLING (1958)	MUMFORD AND GRAY (1957)
2 per cent Lignocaine	38.2±8.3 (34 cases)	48.3 (120 cases)
2 per cent Carbocaine	82.4±6.5 (34 cases)	82.8 (87 cases)
3 per cent Carbocaine	90.6±5.2 (32 cases)	

However, before the drug is finally evaluated it is necessary to compare the anæsthetic potency of carbocaine and lignocaine with adrenaline. Such an investigation is proceeding.

**2. Protection against Systemic Effects of the Anæsthetic Drug.**—It is usually not appreciated that adrenaline, by acting as a pharmacological tourniquet, reduces the systemic absorption of the potentially toxic local anæsthetic drug.

**3. Restriction of Hæmorrhage.**—There is a further advantage of adding adrenaline which deserves mention. When used for infiltration anæsthesia it is possible to restrict hæmorrhage, and this is desirable during certain operations, e.g., gingivectomy.

#### DISADVANTAGES OF USING ADRENALINE

Having considered the advantages of using adrenaline it is important to assess the disadvantages attributed to its inclusion in local anæsthetic solutions for use in dentistry.

**1. Dry Socket.**—Adrenaline, by decreasing the blood-flow to the part, is of importance in the aetiology of dry socket. However, it is considered that the main cause is primarily trauma due to difficulty in the operation and perhaps to the dentist's tendency to give a dose which is slightly too high, "just to make

sure". This is natural and somewhat reasonable because one wishes to obtain successful anæsthesia in as many cases as possible at the first attempt. One of us has tried various volumes of 2 per cent lignocaine with 1 : 80,000 adrenaline and suggests that for regional anæsthesia 1.75 ml. gives a high percentage of successful anæsthesias with a sufficiently short waiting period between injection and onset of anæsthesia. For infiltrations 1.0 ml. is usually sufficient.

**2. Prolonged Numbness and Paræsthesia of the Soft Tissues.**—This is due to the potency of the anæsthetic solution, the adrenaline content, and the dose. Limiting the dose as suggested above helps to lessen the duration of the soft-tissue symptoms. Further reduction may perhaps be achieved by using newer anæsthetic agents, e.g., carbocaine.

**3. Acidity.**—Adrenaline is only stable in acid solutions and this is why local anæsthetics which contain it have acidities as high as pH 3.5. Theoretically, this low pH could lead to decreased effectiveness of the anæsthetic, but practically there appears to be little difference (Tainter, Thronson, and Moose, 1939; Tainter, 1941; Björn and Hultdt, 1947; Hultdt, 1953). However, this acidity could be a cause of irritation and a contributor to afterpain at the site of injection. The difficulty might be overcome if it is found that new drugs, e.g., carbocaine, are suitable without addition of a vasoconstrictor.

**4. Reactive Hyperæmia.**—It has been considered that the vasoconstriction due to adrenaline is followed by a reactive hyperæmia which might be harmful to the pulp.

**5. Adrenaline Shock.**—Whenever a patient feels faint or sick, or looks pale and ill, it is usually called "adrenaline shock". However, this is not always so; in some cases the patient is suffering from a vaso-vagal attack (a simple faint). This is due to overactivity of the vagus nerves. In a fully developed attack the heart slows and the pulse-rate may fall to as low as 40 a minute. There is pallor, sweating, and nausea. Since these are present in adrenaline shock one appreciates the difficulty in differentiating the two conditions. The pulse-rate is the main difference, for in adrenaline

shock it is rapid. There is also pallor, palpitation, dyspnoea, anxiety, nervousness, and headache.

It is not generally realized that these symptoms can follow as a result of the patient's own adrenaline being secreted in excess due to apprehension and fear (autogenous hyperadrenalinæmia). It should be noted that the patient may be outwardly calm and composed and may even be joking and putting on an act to cover up the dread of events to come. It is in these circumstances that the dentist should be on his guard, because giving a local anæsthetic could precipitate a toxic reaction. Whether this is due to the adrenaline content of the anæsthetic solution or to a further increase in autogenous adrenaline due to fear of the needle, or to both, is not known, but care is certainly indicated. The patient must be given soothing attention and constant reassurance. In addition to such psychic sedation, adequate premedication is called for. In this connexion it is interesting to note that Cheraskin and Prasertsuntarasai (1958) have shown that there was a significant reduction in the systolic, mean, and pulse pressure levels in hypertensive patients who were sedated with a central nervous system depressant,  $1\frac{1}{2}$  grains of seconal (quinalbarbitone sodium B.P.), 45 minutes prior to putting the patient in the dental chair.

Above all, however, pain must be avoided by correct technique and successful anæsthesia. With the drugs at present available successful anæsthesia is far more likely in the presence of adrenaline. Moreover, Cheraskin and Prasertsuntarasai (1959) have stated that inducing pain increases the risk of adrenaline being secreted in amounts greater than the quantity introduced in the local anæsthetic solution.

Regarding correct technique it seems desirable to mention aspiration. Much has been written recently about the importance of aspirating before injecting. The object is to avoid injecting the anæsthetic liquid into a blood-vessel, because there is then increased toxicity and decreased anæsthesia. This the writers accept in principle but do not practise, because it needs a wider gauge needle and

more manipulation when the syringe is in the tissues. Both factors increase apprehension, and it is considered that in the small minority of cases in which a vessel will be entered, the advantage of aspirating is offset by the disadvantage for the majority of being subjected to the above factors. In practice it is considered more appropriate to inject slowly. Having stated the above view it seems desirable to say that it is not in accordance with current opinion, at least as expressed in recent publications (Harris, 1957; Hayward, 1957).

If adrenaline shock occurs the effects pass off rapidly. Meanwhile the patient is given rest, quiet, and reassurance. Coats and sweaters may be removed, collars and belts loosened, and the patient placed in a recumbent position. Instead of levelling the chair the patient might prefer to place his head between his knees.

For either position, if the patient is unconscious the dentist should check to see, or rather hear, that respiration is continuing.

When the patient has sufficiently recovered he might appreciate a hot drink sugared to taste. Whatever the physiological value of this may be, it keeps the patient occupied, reduces embarrassment, and is much appreciated.

It is better to postpone operative procedures, but, if the patient wishes to continue, the operation may be completed and the anæsthetic is often found to have been successful.

The above treatment is the same as for a faint. This is fortunate because, as stated above, it is not easy to distinguish between the two conditions.

Perhaps the most impressive statement regarding the use of adrenaline in local anæsthetics for dentistry was made in a report by the New York Heart Association (1955). Referring to its use for patients with heart disease they said: "We would recommend for any one session that there be used no more than 10.0 c.c. of 1:50,000 epinephrine (adrenaline)—no more than 0.2 mg. of epinephrine in any form."

Such a dose is far larger than that normally used, so it is evident that the dentist may

feel secure when using local anaesthetics with adrenaline, but must do two things:—

a. Ask the patient about his general health, especially regarding the cardiovascular system, and previous anaesthetic history. The time to do this is at the first visit when making the diagnosis and treatment plan: not immediately before the injection, because this might increase nervousness.

b. Consider using premedication in appropriate cases.

Finally it is interesting that the law in Denmark expressly forbids a dentist giving a local anaesthetic without adrenaline (Wiedling, 1952).

**Other Vasoconstrictors.**—It is considered that discussion of these is beyond the scope of this paper, but the opinion expressed in *Accepted Dental Remedies* (1959) is of interest:

"There is not adequate evidence at present to indicate the superiority of any one of the vasoconstrictor agents when employed in physiologically equivalent concentrations in anaesthetic solutions." This view appears to be similar to that of Geddes (1954) and Björn (1956).

### SUMMARY AND CONCLUSIONS

The role of adrenaline in local anaesthetic solutions for use in dentistry is considered, as are the advantages and disadvantages of using it.

It is considered that the dentist should inquire into the patient's general health,

especially the cardiovascular system, and anaesthetic history.

A sedative should be given in appropriate cases. A soothing approach should be used and correct technique practised.

Under these conditions local anaesthetics should be used with adrenaline, because this gives far greater chance of successful anaesthesia and thus guards against pain and hyperadrenalinæmia, which might be harmful to some patients.

Other vasoconstrictors may be used instead, but they appear to have no special advantage over adrenaline.

It is possible that newer drugs, e.g., carbocaine, may not need the addition of adrenaline.

### REFERENCES

- Accepted Dental Remedies* (1959), 24th ed., 115. Chicago: American Dental Association.  
 BERLING, C. (1958), *Odont. Revy.*, **9**, 254.  
 BJÖRN, H. (1956), *Ibid.*, **7**, No. 3.  
 — and HULDT, S. (1947), *Svensk. tandläk. T.*, **40**, 831.  
 CHERASKIN, E., and PRASERTSUNTARASAI, T. (1958), *J. Amer. dent. Ass.*, **56**, 210.  
 — — — (1959), *Ibid.*, **58**, 61.  
 GEDDES, I. C. (1954), *Brit. J. Anaesth.*, **26**, 208.  
 HARRIS, S. C. (1957), *J. oral Surg.*, **15**, 299.  
 HAYWARD, J. R. (1957), *North-W. Dent.*, **36**, 153.  
 HULDT, S. (1953), *Acta odont. scand.*, **11**, Suppl. 13.  
 MUMFORD, J. M., and GRAY, T. C. (1957), *Brit. J. Anaesth.*, **29**, 210.  
 NEW YORK HEART ASSOCIATION (1955), *Oral Surg.*, **8**, 225.  
 TAINTER, M. L. (1941), *Anesthesiology*, **2**, 489.  
 — — — THRONDSO, A. H., and MOOSE, S. M. (1939), *J. Amer. dent. Ass.*, **26**, 920.  
 WIEDLING, S. (1952), *Anaesthetist*, **4**, 119.

### Methods of Fixation in Mandibular Bone Grafts

Methods are reviewed which preserve the gap between the bone ends after tumour resection and, in so doing, avoid facial deformity and facilitate the ultimate placement of a bone graft. Many such devices have disadvantages.

A successful appliance should be easily adaptable, strong, simple, cheap, easily inserted and removed, small but stable, versatile, and non-corrosive. A new device which fulfils these criteria is described.

It is a Kirschub stainless steel pin, 9 in. long and  $\frac{3}{32}$  in. diam. It is threaded and two nuts

and washers are screwed on, one at each end. When it is used, a hole 2 cm. deep is drilled in each bone end. The pin is cut to length, bent to a suitable shape and the ends inserted into the holes. The nuts and washers are screwed out against the bone ends to prevent the fragments approximating.

If it becomes necessary to remove the pin, it may be cut through in the middle through a stab incision and the two halves drawn out. Normally, the graft can be built up round the pin, either at the first or subsequent operation.  
 — HENRY, F. A., and MCCLELLAND, W. D., jun. (1959), *J. oral Surg.*, **17**, 35.



## NATURAL TOOTH PLACEMENT AND BASE CONTOUR IN FULL DENTURE CONSTRUCTION\*

### ANATOMICAL LANDMARKS TO INDICATE CORRECT PLACEMENT OF TEETH

By GEORGE FRANKLIN McGEE, D.D.S., F.A.C.D., *San Francisco, California*

THE dictionary gives the following definition: "Prosthesis—the addition to the human body of some artificial part". It seems logical from this definition that when any prosthetic appliance is constructed it should, in function and appearance, copy the lost part as closely as

possible. Immediate dentures are usually superior to delayed dentures in this respect because the anterior teeth can be accurately replaced. However, the vast majority of dentures are constructed in edentulous mouths with no pre-extraction records, and with only the questionable memory of the patient, old dentures, and our own past experience to guide us.

It has been the habit of most dentists and dental technicians to place both anterior and posterior teeth over the crest of the residual ridge. This produces good results in the postural portion, but almost always places the anterior teeth too far back in the mouth in relation to the position of the natural teeth. This condition results in lack of proper support for both upper and lower lips and gives a definite altered appearance in the lower third of the face. This change in facial contour is one of the main objections of the average patient and is also one of the reasons why many prospective denture patients retain infected and defective teeth which are injurious to their health and cause loss of supporting tissue. If this apprehension could be eliminated, patients might be more willing to accept dentures at an earlier date before destruction of supporting tissue presents a serious problem to the dentist.

The future denture patient usually waits five to ten years beyond the time when he should lose his teeth. There are many reasons for this delay, but perhaps the outstanding one is fear that his natural appearance cannot be reproduced. This obstacle could be eliminated to a great extent in the minds of patients if denture prosthesis copied the original condition more accurately. (Fig. 1.)

Some years ago it was suggested that with a closer look at surface anatomy of the oral tissues and position of the teeth, some clue might be found that would help to locate the proper position of the anterior teeth on the

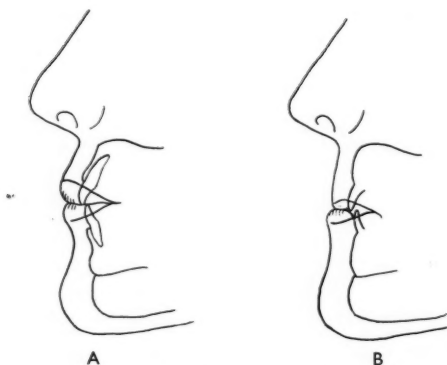


Fig. 1.—A. Tracing from cephalometric X-ray of natural lip and tooth placement. B. Change caused by improper placement of teeth on artificial dentures.

possible. In many instances this result is not obtainable. In our own special field of full denture construction, where the possibility of meeting these qualifications exists to a greater extent, how have we met the problem?

It cannot be denied that with the materials available and the techniques developed, vast improvements have been made. However, instead of relying on many of the methods and teachings of the past, would it not be better to take a closer look at Nature's method of tooth placement and contour of tissues, with the result of achieving greatly improved aesthetics, and more comfort and satisfaction to the denture patient?

\* Paper read before the American Dental Society of Europe, in Stockholm, Sweden, July 6-10, 1959.



denture base. The first landmark that attracted attention in the anterior region of the maxillary process was the incisive papilla. Now, *how* could the importance of this fibrous prominence have been neglected for so long? The only answer is that we see only that which we expect and are trained to see.

The incisive papilla is a fibrous covering over the incisive foramen, a funnel-shaped



Fig. 2.—Showing gradual change of foramen under the papilla, and method of closely determining original angular position parallel to adjacent anteroposterior slope of palate.

opening on the midline of the palatine process and immediately behind the mesial surfaces of the two central incisors. For some time after the teeth are removed the incisive papilla remains in its original position. However, due to progressive bone loss, especially that of the labial plate, an illusion is produced and the papilla seems to move forward. The foramen under the papilla cannot move, but its opening can be altered, causing this apparent change. Fig. 2 shows this gradual change and the method of closely determining the original angular position parallel to the adjacent anteroposterior slope of the palate.

A line drawn through the middle of the incisive papilla in an anteroposterior direction will pass through the contact point of the mesial surfaces of the upper right and left central incisors. A line drawn at right angles to the original line and bisecting the papilla in the opposite direction will, in a great many cases, touch the curved lingual surface of the centrals at the gingival line. In some cases the lingual surface will be slightly anterior to this position (Fig. 3).

In order to place the centrals as close as possible to their original position, it is necessary to find the average diameter of a central incisor at the gingival line. It is surprising to find the variance is from 6.8 mm. to 8.6 mm. The average is 7.7 mm. Considering the fact that in some cases the central incisors are found to be slightly anterior to the base line selected, a measurement of 8 mm. has been

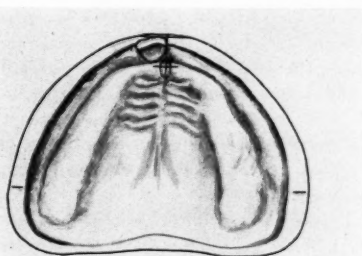


Fig. 3.—Lines on model locating central incisors and distal of second molars.

decided upon and has been used very successfully by the author for many years.

Before a trial base is made, the upper edentulous cast is marked as follows. The papilla is bisected in both directions. The anteroposterior line is continued forward to mark the cast outside the coverage area. In the upper right-hand quadrant formed by the original lines and touching each, a circle 8 mm. in diameter is made. A line can now be made on the base of the cast that would be even with the most anterior curve of the circle. This locates the labial surfaces of the two central incisors in the average case. It must be understood that 8 mm. is an average measurement and only a starting position for the placement of the central incisors. This position may be altered in an anterior or posterior direction to meet the requirements of the individual case.

The anteroposterior position of the central incisors having been determined, vertical inclination and length of all upper anteriors are found in the following manner. The six upper anterior teeth not only position the upper lip but their incisal edges position the

lower lip by making contact with the lingual half of its vermilion border in both rest and occluded positions. Thus the six upper anterior teeth are placed to accomplish this function, establishing the vertical inclination and curvature of the anteriors. In normal relationship, where the over-jet and over-bite are not over 3 mm., the labial surfaces of the upper centrals are usually found to be parallel to the profile or inclined slightly inward at the incisal edge. If this position is correct, a phonetic test can be made with the pronunciation of the letters *f* and *v*. The incisal edges of the upper teeth will make a firm contact with the lower lip at the correct point. This procedure will be found correct in all cases except that of a true mandibular protrusion.

The curvature of the upper anterior teeth may be checked by the operator gently raising the upper lip. Any incisal edge that does not make contact with the lingual half of the vermilion border, the tooth, or teeth, should be moved forward. Any incisal edge making contact anterior to the lingual half of the vermilion border should be moved back. When the lips are slightly parted, the incisal edges should be parallel to the curve of the lower lip as it rises from the median line to the corners of the mouth.

Examination of a great many artificial dentures will show the central incisors directly above and often behind the incisive papilla. This condition will also be the cause of all posterior artificial teeth being placed distal to their original position. This places the second molar on the denture, occupying the natural position of the third molar directly over the tuberosity. When a mark is made on the land of the upper cast opposite the anterior edge of the tuberosity and with the anterior teeth in place, a measurement can be made from this mark to the distal of the cuspid and proper size posterior teeth can be selected.

The lower anterior teeth are placed over the labial half of the lower residual ridge. The vertical inclination is at right angles to the lower border of the mandible. The incisal edge is even with or slightly higher

than the lower lip at rest. This procedure will produce close approximate position of the original teeth. With the six upper and six lower anterior teeth in place, the temporary bases are placed in the mouth and adjusted to produce the correct over-jet and over-bite for the individual case. On the lower edentulous cast the triangular shapes of the retro-molar pads are outlined in pencil. On each side a mark is made on the cast opposite the apex of the triangle. The pad is bisected in an anteroposterior relation, and marks are also made on the cast opposite these points. The first mark locates the distal of the second molar, and the second mark indicates the height of the occlusal plane. This latter position may be checked on any lower cast where the third molars are missing. The older method of placing the occlusal plane at a point midway in the space between the upper and lower edentulous ridges almost always places it too high in relation to the lower ridge. The additional leverage created usually results in discomfort and instability to the denture patient.

If, after the set-up is completed, the soft-tissue areas are carved to copy the contours found normally in the mouth, the result will be more pleasing and natural than that produced in the average denture. Over the years we have found that the use of anatomical landmarks has greatly facilitated tooth placement in comparison with older methods, and has produced very satisfactory results.

#### NATURAL CONTOUR OF DENTURE BASES

The placement of teeth in their natural position is not the only problem in constructing a modern denture. The denture base should also have the same anatomical form as that of the tissue replaced and the areas covered. The study of well-made casts, having a full complement of teeth and showing the adjacent tissue, is all that is needed to gain the necessary information to simulate Nature. All mouths are similar anatomically and vary only in degree of height of a prominence or depth of a fossa.

### UPPER DENTURE CONTOUR

The six upper anterior teeth, incisive fossa, cuspid eminences, and gingival bulge support the upper lip in its normal position (Fig. 4). The vermilion border is of proper size, the philtrum is well defined, and the upper lip is usually concave in profile. In the average denture seen to-day the six anterior teeth are usually placed too far back in the mouth, there is no incisive fossa, and although the cuspid eminences are often present, they are usually obliterated by the gingival bulge terminating at the upper periphery of the denture. This results in a very thin vermilion border, non-existent philtrum, and a longer than normal upper lip which may have a convex profile.

Distal to the cuspid eminence and above the bicuspid is the canine fossa. The presence of this fossa makes it possible for the bicuspid and the gingival bulge above these teeth to support the corner of the mouth. Although seldom seen on the average denture, this depression is of real importance if normal facial expression is to be retained. Even when dentures are constructed with correct vertical dimension, the corners of the mouth often turn down. To avoid this condition, it has been the habit in the past to add bulk to cuspid eminences and extend this bulge to the bicuspid area. This results only in an unnatural appearance and does nothing but accentuate the condition. Correct contouring in the anterior and bicuspid regions of a denture will do a great deal to obtain the patient's confidence in maintaining his former natural appearance.

Above the molars is the malar process. This is a convex bulge extending from the gingiva of the molars to the reflex tissue above them, and is especially prominent above the distal half of the second molar. This convexity supports the buccal tissue, and when duplicated on a denture will prevent most cheek biting. Too frequently the average denture is concave rather than convex in this area, resulting in tissue being supported only by the buccal surfaces of the molars and causing distress to the patient because of constant cheek biting.

On the palatal surface there is a gingival bulge on all posterior teeth. It is slight in the bicuspid region, becoming more prominent near the second molar. Because this is a normal contour it should be replaced on a denture. In the anterior portion of the palate the rugæ and incisive papilla should be reproduced in natural shape and position. This,

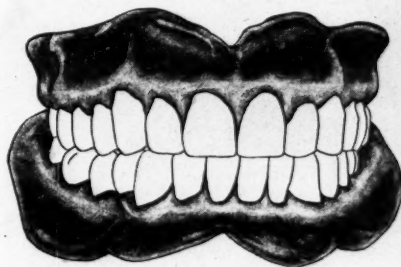


Fig. 4.—Average contour of labial and buccal surfaces.

with proper placement of the anterior teeth, will reduce phonetic problems and facilitate removal of food particles from the palate. One of the main difficulties with artificial teeth is the inability of patients to enunciate clearly. Upon examination of many dentures it is often found that the anterior teeth, instead of being in front of the papilla, are positioned directly above and sometimes behind this important landmark, thus creating a definite speech problem. Correct placement of teeth reduces this problem to a minimum.

### LOWER DENTURE CONTOUR

Below the lower six anterior teeth is a small gingival bulge, and the rest of the labial surface is concave. This contour supports the lower lip and allows the tissue in the reflex to seal the anterior border of the denture (Fig. 5). In the average denture the labial bulge often extends from the gingiva to the lower border, making the entire surface convex. This causes an unnatural fullness of the lower lip and adds to the difficulty of denture retention in this area. In the bicuspid and molar region the gingival bulge is also present and is most prominent below the first and

second molars. Here it forms a natural food table, and in conjunction with the malar process holds the buccal tissue away from the teeth and prevents cheek biting. The rest of the surface below the bulge is concave to the denture border, allowing the periphery to be sealed by the buccal tissues. In the ordinary denture this surface is usually concave from

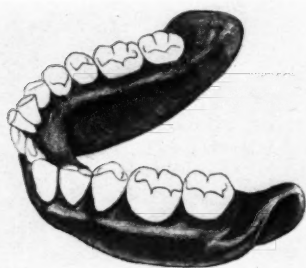


Fig. 5.—Average contour of lower denture.

the gingiva to the denture border, causing the teeth to be the only support. This results in discomfort due to cheek biting and accumulation of food during mastication.

On the lingual surface opposite the bicuspid and molars there is also a gingival bulge. It is slight, however, near the bicuspid, but thicker near the molars. From this bulge to the lower lingual border the surface is concave, allowing more freedom for the base of the tongue and providing a better peripheral seal in this area. In certain cases where there has been a great loss of the residual ridge and supporting tissues, the gingival bulge can be exaggerated in size, allowing the tongue to rest on this rounded surface, thus helping to stabilize the lower denture. This surface on artificial dentures is usually convex from the teeth to the border, thus limiting tongue space and reducing denture retention. Normal contour of both upper and lower dentures is possible only if all available supporting surfaces are covered by the denture base, and peripheries extend to, and are in contact with, the limiting reflex tissues. In other words, an under-extended denture cannot be correctly contoured.

## CONCLUSIONS

Since proper vertical dimension can only be correctly determined (whatever the method) with the use of properly fitted base plates and contoured wax rims, all the landmarks given for placing teeth may be used to contour the wax rims. Thus, except for their vertical height, the wax rims are almost completed before they are placed in the mouth. This cuts chair time and guesswork to a minimum.

Denture patients cannot appear natural to themselves or to others who know them, and they cannot be blamed for delaying the loss of their teeth as long as possible when we fail by a wide margin to reproduce the original appearance. It is true that improvements in abnormal conditions can be made, but until we understand and can reproduce normal conditions, we have much to learn. The æsthetic problem of denture construction has been advanced by characterization of the teeth and denture base tinting, but the full possibilities cannot be realized until we learn to place teeth in their normal, natural positions.

Normal contour of the soft tissues can easily be reproduced by study of the mouth, and from casts made from mouths with the teeth present. This will also result in dentures with better retention and stability. It will greatly eliminate cheek biting and will give natural food tables to prevent packing of food on buccal surfaces. There will be more room for the tongue, better phonetics, correct lip position, and a desirable upturn of the corners of the mouth. Are not all these factors worthwhile and desirable?

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## CONGENITAL EPULIS OF THE NEWBORN

By T. TALMAGE READ, M.Ch.D., F.R.F.P.S., F.D.S. R.C.S., H.D.D., L.R.C.P.  
and W. S. CRAIG, B.Sc., M.D., F.R.C.P.E., F.R.C.P., F.R.S.E.

An epulis in a child or adult signifies a swelling arising from the gum, periosteum, or periodontal tissues, usually in relation to the teeth. It is more frequently of a chronic inflammatory than of a neoplastic nature, but the term indicates the site rather than the pathological nature of the swelling.

The so-called congenital epulis is a unique type of epulis. Not only is it present at birth but it presents special histological features characterized, in particular, by the presence of large cells with granular cytoplasm (see Figs. 2-4). In consequence it has been classed as an example of granular cell myoblastoma, a neoplasm which implies a myogenic origin and which develops by the proliferation of immature muscle-cells.

The myoblastoma occurs more frequently elsewhere in the body, especially in relation to striated muscle tissue, and notably in the tongue, a site which constitutes more than a third of the cases. It may be found, however, in sites where muscle tissue is not present, most frequently in the skin and subcutaneous tissues, and where the explanation of its origin is less obvious. The occurrence of the tumour in the gum, for example, is explained on the basis of Cohnheim's theory of tumour formation, namely from misplaced embryologic rests consisting of primitive muscle-cells due to the close developmental relationship of the skin or mucosa and muscle anlage (Klinge, 1928).

The muscle origin of the tumours is supported by the supposed resemblance of the large granular cells to embryonic muscle-cells, and to the histological appearances suggesting a transition to the formation of muscle-fibres.

The diffuse granularity of the cells is replaced by a linear arrangement of granules within the cells, which also show elongated ribbon-like forms with cross striæ and the apparent development of longitudinal striated fibrils.

The common site of the epulis type is the maxilla and less frequently the mandible (Hankey, 1955; Darling and Fletcher, 1957). It is a rare condition. Of a total of 162 cases of myoblastoma collected from the literature by Crane and Tremblay in 1944, it constituted



Fig. 1.—Clinical appearances. Cherry-like, red, pedunculated swelling in right upper incisor region.

11 cases. Ten of these latter cases occurred in females, an interesting sex relationship which is characteristic. Seven of the 11 cases were located in the maxilla, all of which were present in newborn infants (Crane and Tremblay, 1944).

Whilst the occurrence of the myoblastoma in other sites is usually in later years, it is possible that even if present in the newborn they would not be recognized so readily as a lesion on the gum.

The histogenesis is still in debate by pathologists, but to the clinician it is satisfactory to note that identification gives a good prognosis. Contrary to what one might expect of a neoplasm thought to arise from embryonic muscle-cells, the condition is slow growing and benign and if removed completely does not recur.

### CASE REPORT

Baby C., a female infant, was the first-born of a mother aged 25 years with an uneventful antenatal history.



The estimated period of gestation was 37 weeks. Labour pains were never effectively established, and the membranes were ruptured 72 hours prior to delivery, which was by Caesarean section because of sustained fall in the fetal heart-rate. The birth-weight was 5 lb. 15 oz., and

Operation was on the fifth day of life and the baby was put to the breast for the first time on the evening of this day. Progress was uneventful and the infant left hospital on the 14th day with breast-feeding securely established and weighing 6 lb. 5 oz.

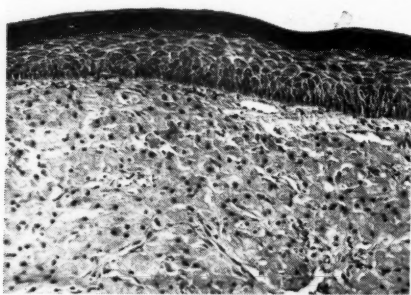


Fig. 2.—Section to show smooth surface layer of stratified squamous epithelium and sheet of large granular tumour cells with capillaries and scanty stroma. H. and E. ( $\times 93$ .)

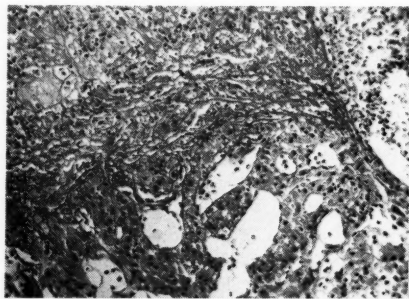


Fig. 3.—Fibrillar arrangement of tumour cells and vasoformation. H. and E. ( $\times 93$ .)

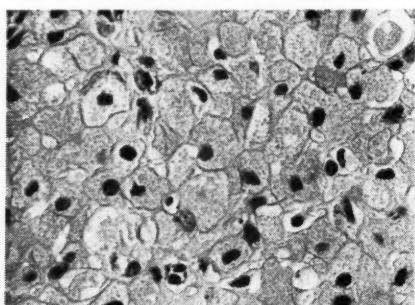


Fig. 4.—Section to show the characteristic large granular tumour cells whose identity is debatable. H. and E. ( $\times 362$ .)



Fig. 5.—Clinical appearance 9 months after operation. Normal healing and no recurrence.

the condition at birth was satisfactory, the infant gasped immediately and effective rhythmic respirations were established without delay.

The general appearance and behaviour were in keeping with a slight degree of prematurity, and nursing care was provided in an incubator for the first 24 hours of life.

**BUCCAL ANOMALY.**—A small pedunculated red swelling was noted in the upper jaw at the time of the first examination immediately after birth. The swelling was soft but firm, did not fluctuate, and was situated in the right lateral incisor region arising on the crest of the alveolar ridge (Fig. 1). There was no evidence of inflammation or injury. Development of the jaws was satisfactory, the swelling appeared to be confined to the soft tissues, and the bone did not appear to be involved.

Feeding was by bottle and did not present difficulty.

**OPERATION.**—Excision of the tumour was carried out under local anaesthesia, and the wound sutured.

**PATHOLOGICAL EXAMINATION.**—The excised specimen measured  $1.5 \times 1$  cm. and was red, firm, and with a smooth non-ulcerated surface. Sectioning presented a firm greyish-white cut surface.

Microscopically the tumour consisted of closely-packed cells in sheet form, with scanty stroma and numerous capillaries. The surface had a covering of stratified squamous epithelium, which was smooth and did not show the hyperplasia sometimes associated with the tumour in other situations. Immediately underneath was a narrow band of fibrous tissue demarcating the periphery of the tumour and separating it from the surface epithelium. The tumour cells were large with polyhedral and elongated forms and abundant acidophilic cytoplasm. The nuclei were small and situated both centrally and eccentrically. No mitoses were present. A characteristic feature was the presence in the cytoplasm of fine acidophilic granules (Figs. 2-4).



## DISCUSSION

The histogenesis of the granular cell myoblastoma is controversial. It is probable that the only true myogenous examples are those associated with striated muscle, such as the lingual myoblastoma. Here again, the lesion may be degenerative and reparative following injury, rather than neoplastic (Willis, 1948).

The heterotopic varieties which are found in situations normally devoid of muscle-tissue, such as the skin, gum, and mammary gland, may have a versatile origin. The theory of origin from embryonic muscle-cell rests is doubtful, as the characteristic granular cell apparently is not identical with the embryonic myoblast (Gray and Gruenfeld, 1937). A neural origin has been put forward, based on the finding of nerve fibrils in certain types and the appearances of a granular neurofibroma (Fust and Custer, 1949).

The similarity of the granules in the tumour cells with those found in fibroblasts, as demonstrated by the morphological and histochemical appearances, suggests the fibroblast as the precursor cell and the tumour consequently a granular fibroblastoma (Pearse, 1950).

Certain tumours diagnosed as myoblastomas in the mammary gland have a glandular appearance, suggesting an origin in glandular epithelium which has subsequently degenerated.

The congenital epulis may also be a distinct pathological entity, and in view of its situation in the jaws an odontogenic origin may be significant (Willis, 1958). It has, for example, been thought to be an embryonic hamartoma arising from a malformation of the dental blastema. Epithelial rests are so commonly found in the jaws that their association with the condition may, however, be accidental. The various possibilities would require a lengthy discussion outside the scope of this article, but the identification of the granular cell with an odontogenic precursor has still to be established.

## SUMMARY

1. A congenital epulis in a newborn female infant, having the histological appearances of

the so-called granular cell myoblastoma, is described and illustrated.

2. The salient clinical features were:—

a. The swelling was present at birth. It was pedunculated and situated in the right lateral incisor region of the maxilla.

b. Twelve months after excision there were no signs of recurrence, and the general development and health of the infant were found to be good.

3. The histological appearances of the tumour are described and the nature of granular-cell myoblastomas in general briefly discussed.

**Acknowledgements.**—We are indebted to Mr. H. Agar for kindly referring the patient, to Dr. T. W. Sutherland and Dr. W. Goldie for their helpfulness and advice, and to Mr. L. Jepson for the photographs.

## REFERENCES

- CRANE, A. R., and TREMBLAY, R. G. (1944), *Amer. J. Path.*, **21**, 357.  
 DARLING, A. I., and FLETCHER, J. P. (1957), *Oral Surg.*, **10**, 81.  
 FUST, J. A., and CUSTER, R. P. (1949), *Amer. J. clin. Path.*, **19**, 522.  
 GRAY, S. H., and GRUENFELD, G. E. (1937), *Amer. J. Cancer*, **30**, 699.  
 HANKEY, G. (1955), *Proc. R. Soc. Med.*, **48**, 1015.  
 KLINGE, F. (1928), *Verh. dtsh. path. Ges.*, **23**, 376.  
 PEARSE, A. G. E. (1950), *J. Path. Bact.*, **62**, 351.  
 WILLIS, R. A. (1948), *Pathology of Tumours*, 743. London: Butterworth & Co. (Publishers) Ltd.  
 — (1958), *The Borderland of Embryology and Pathology*, 262. London: Butterworth & Co. (Publishers) Ltd.

## Cephalometric Roentgenography of Infants: Sedation, Instrumentation, and Research

A detailed statement of the theory and practice of sedation is given. The rest position of the mandible as recorded in the premedicated infant is remarkably constant. A similar posture is recorded at a later age with the unpremedicated child in the supine position and again sitting upright. Serial investigations of a variety of deformities of the brain case and facial skeleton are presented.—PRUZANSKY, S., and LIS, E. F. (1958), *Amer. J. Orthodont.*, **44**, 159.

## A SIMPLE DEVICE TO SUPPORT THE ANGLE OF THE MOUTH IN BELL'S PALSY

By C. C. KNOWLES, B.D.S., D.D.O.

Lecturer in Orthodontics, Liverpool Dental School

SEVERAL patients suffering from Bell's palsy have recently been referred to the Liverpool Dental Hospital. They were most of all concerned about the asymmetry of the mouth resulting from the unilateral paralysis of the muscles of facial expression. Drinking was

through the medium of silver cast splints. Although Fickling originally included an extension to support the angle of the mouth this extra-oral part was eventually discarded since it was felt that it would break whatever lip seal might have been present.

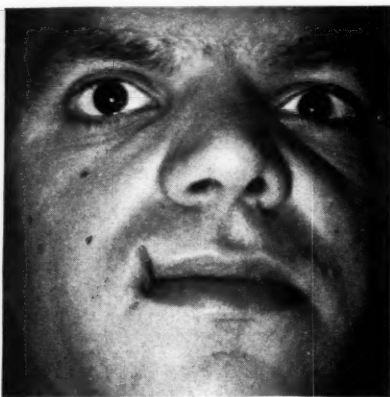


Fig. 1.—P.V.C. tubing covering the cut end of the wire.

also obviously difficult, and the overflowing of tears on the affected side proved an embarrassment.

If the facial muscles on the affected side can be supported, there is an immediate improvement in the appearance and drinking may become a little easier. Completely extra-oral supports are of necessity unsightly. Either a loop of wire passing over the ear and inserted into the angle of the mouth on the affected side or strips of elastic adhesive plaster have been used. The intra-oral support has the advantage that, being almost completely or totally out of sight, it does not draw attention to the patient's condition.

Fickling (1951) described an intra-oral support in the form of an acrylic pad which could be attached to either a full or partial upper denture or to the teeth themselves

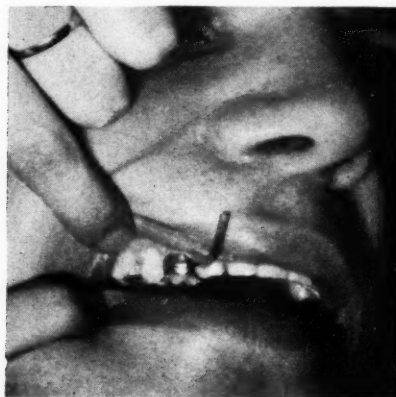


Fig. 2.—Appliance cemented in place. Note the good contact points.

Turrell (1959), in a review of the whole subject of facial paralysis, has described a support similar to that of Fickling. Turrell, however, found that many dentures were displaced during mastication when the flange was extended to give adequate support. For this reason he designed the support to be easily removable by the patient, so that during mastication no displacement occurred and there was no risk of damage to the tissues of the sulcus. Because cast splints will frequently gag the bite, Turrell also describes a method of attaching the cheek support to an orthodontic band.

An intra-oral method of applying traction to the angle of the mouth has been described by Dahlberg (1944). The appliance consists of an orthodontic molar band carrying a hook to which is attached an elastic band pulling

on an acrylic fitting to the angle of the mouth.

It would seem that there is some risk of permanent stretching of the paralysed muscles whenever any form of elastic traction is applied, and methods which give passive support are to be preferred.

In those cases where the paralysis is transient, lasting for three or four weeks only, the following method has been found to be successful. It has the advantage that it can be made at the chair-side in about twenty minutes, and does not require any impression or the services of a technician. It can only be used, however, where there are suitably placed standing teeth.

When there is a complete arch of teeth and good contact points, an orthodontic band is made for the upper first premolar only. To this is welded and soldered about one inch of 1 mm. stainless steel hard wire, which has been annealed except for the short length by which it is attached to the band.

Before cementing the appliance, the wire can be approximately adjusted to position. Final adjustments can be made after the appliance has been cemented, and the annealed length will be found to bend quite easily. The wire can now be cut to length, with the end just beyond the vermilion border of the upper lip. A length of P.V.C. tubing slipped over the wire can be adjusted by the patient to the position of greatest comfort and this also serves to cover the cut end of the wire (Fig. 1).

#### Sweet Tooth and Decay

On the average a child aged four years has at least four bad teeth and each year through childhood one or two teeth are added to the total number affected. Dental research workers are agreed that the caries process is initiated by the products of bacterial activity in the mouth where food particles stagnate. The strength of the acid thus formed, and the length of time it remains undisturbed in contact with tooth enamel, determines whether primary tooth decalcification, the first step in the caries process, will take place. There are three main

Although the entire weight of the upper lip is supported by the single tooth, no discomfort has been reported in the 4 cases treated so far. As there have been complete arches with good contact points all round, the tilting reaction on the banded tooth has been absorbed around the whole arch (Fig. 2).

Should the tooth chosen for banding be isolated, then a lingual arch attached to a tooth on the opposite side would give additional support.

Should it become apparent that the paralysis is likely to be permanent, or at least of very long duration, then the removable intra-oral support described by Turrell would be advisable. The appliance described by the writer is intended for cases of short duration only.

In the 4 cases treated so far, function has returned after about four weeks and no ulceration of the upper lip has been noticed. In use the appliance is less noticeable than the black and white illustrations would indicate.

**Acknowledgements.**—The writer wishes to thank Professor E. D. Farmer for bringing the cases to his notice and Mr. J. S. Bailie of the Photographic Department, School of Dental Surgery, Liverpool.

#### REFERENCES

- DAHLBERG, A. A. (1944), *J. Amer. med. Ass.*, **124**, 503.  
FICKLING, B. W. (1951), *Brit. dent. J.*, **90**, 115.  
TURRELL, A. J. W. (1959), *Dent. Pract.*, **9**, 218.

lines of approach to the prevention of dental caries: the elimination or inhibition of bacterial activity; the removal of the substrate; and the increase of tooth resistance to attack. At the 1958 Congress of the Royal Society of Health, the following rules for the maintenance of dental health were given: (1) No eating or drinking between meals; (2) Regular meal-times of planned diet; (3) Rinsing the mouth with plain water three times after eating or drinking, using the bubble and swallow technique; (4) Instruction of young children in oral hygiene.—*Brit. med. J.*, Editorial (1958), **2**, Aug. 2.

## REHABILITATION FOR A DENTITION AFFECTED BY HEREDITARY DENTINOGENESIS IMPERFECTA

By N. LIVINGSTONE WARD, L.D.S., D.D.S.

*The London Hospital Dental School*

### CASE REPORT

A MALE child, aged 12 years, was referred to the Hospital with the request to examine the possibility of improving the aesthetic appearance of his teeth. He was an intelligent, fair-complexioned boy, with no noticeable

excessive wear (Fig. 1). The enamel was deficient in quantity and quality, being more sparse on the upper and lower incisors and completely absent on the first permanent molars. The structure of the enamel showed generalized pitting, was hard, greyish in colour, and



Fig. 1.—A, General appearance of teeth—anterior view; B, Maxillary teeth, showing denuded upper first molar.

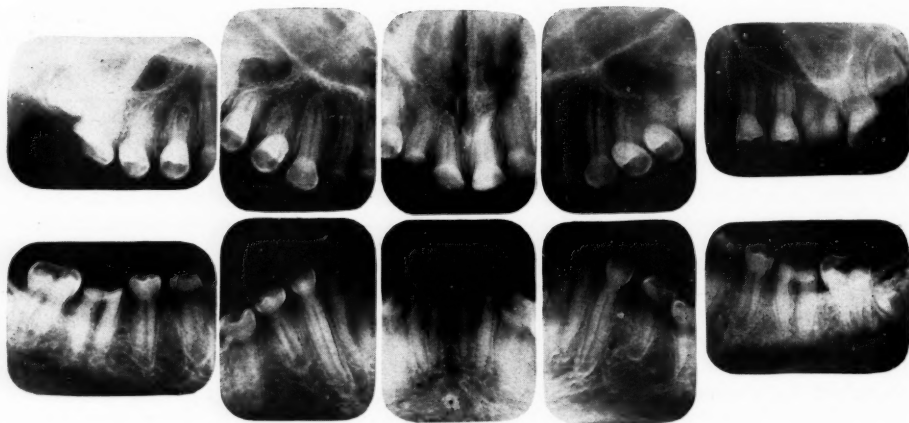


Fig. 2.—Radiographic appearance of teeth.

abnormalities apart from his teeth. The dentition was complete except for the absence of the right upper first molar, which had been previously extracted. X-rays showed the third molars to be present in their crypts. On examination, all the teeth, which were greyish-brown in colour, showed deficiency of enamel and

gave the clinical appearance of hypoplasia. The upper and lower incisors showed marked attrition and only about one-quarter of the crowns remained. The three first permanent molars present were denuded of enamel and worn down to the gingival margin. The exposed dentine was light brown in colour, eburnated, and slightly

transparent. The only carious tooth present was the upper left second molar, which had to be extracted. Full-mouth radiographs showed that the roots were markedly shortened, with very small pulps (Fig. 2). The crowns of the teeth were of normal size but appeared bulbous in relation to the roots.

Further investigation revealed that the dentitions of certain other members of the family had been similarly affected. The family consisted of parents and three boys, of whom the eldest and youngest were affected. The

"imperfecta" dentine. The small amount of enamel available for examination in the ground sections appeared to be normal in prism structure, although it was brownish in colour. A true assessment of the enamel could not be made owing to the small amount left after the ground section had been prepared.

From the histological examination, together with the radiographic evidence and family history, the diagnosis of hereditary dentinogenesis imperfecta was made. However, the gross pitting and wrinkling of the enamel

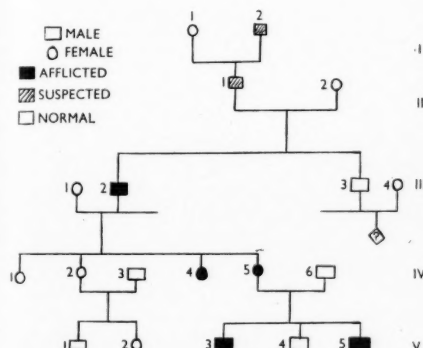


Fig. 3.—Genealogical table—V3 is the patient under treatment.

middle boy, aged 7 years, possessed a normal dentition. The youngest boy, aged 2 years, possessed his full deciduous dentition, but the crowns of all teeth did not exist. The teeth are all level with the gingiva and have the brown polished appearance of dentine. The patient is unfortunately too young for a complete examination by X-rays and photographs. The mother had been similarly affected, and all her teeth had been extracted at 17 years of age. The eldest sister of the mother was stated to have had the same affliction but two older sisters and their offspring were not affected. The maternal grandfather was stated to have had similar teeth, but his brother had normal teeth. Going back to the fourth and fifth generations, the mother's grandfather and great-grandfather were reputed to possess teeth of similar type. There was no history of any member of the family on the paternal side being affected by this condition. The mother who gave this evidence was a highly intelligent person and there was no reason to doubt her word. The whole family knew of this affliction and it was referred to as a family scourge going back through five generations (Fig. 3).

**HISTOLOGICAL EXAMINATION.**—The upper molar tooth, which was extracted, was subjected to microscopic examination. Half of the tooth was prepared as a ground section for examination of the enamel and the other half was decalcified and sectioned for examination of the dentine. The decalcified section showed that the tubular system in the greater part of the dentine was abnormal. Tubules were sparse and many seemed to end in small clusters of branches without reaching the dentine surface, although in a few instances they ended in angular or club-shaped dilatations or spaces. There was a layer of normal first-formed dentine beneath the enamel, with a fairly abrupt change to disorderly

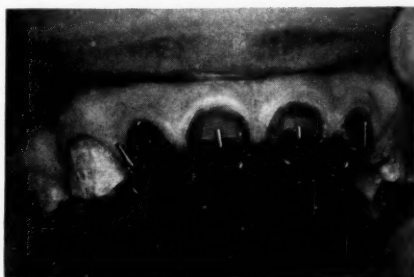


Fig. 4.—Preparations and pins in situ before impression.



Fig. 5.—Completed crowns.

indicated that there was a possibility of a hypoplasia of the enamel superimposed on the condition to such an extent that it was thought, on first appearance, to be a case of hereditary amelogenesis imperfecta.

**TREATMENT.**—Restorative treatment for this type of dystrophy is obviously difficult. In the majority of cases they are allowed to lapse until the time arrives for complete extraction and provision of full upper and lower dentures. In this particular case the patient was only 12 years old and was suffering psychologically by the unkind comments of his schoolfellows over the unusual appearance of his teeth. His mother, who had also suffered from the same affliction, was as worried and as anxious as he was for some sort of treatment if it were at all possible. If the boy had to continue with his affliction, his education and psychological outlook on life might have suffered.

Treatment in these cases may be considered on three lines: (a) Extractions and dentures; (b) An onlay denture over the teeth; (c) Crowns.



The question of extractions was never even discussed, as it was felt that this was a defeatist policy.

An onlay denture over teeth with large areas of dentine exposed would almost certainly have led to rapid caries and loss of the teeth. The teeth, however, could have been covered with small gold caps and an onlay denture made to fit over them, but the retention of the denture would have created a problem.

It was therefore decided to attempt to crown the vital teeth. In some teeth it was thought that pulp extirpation might have been necessary with the provision of post crowns, but this problem did not arise. It has, however, to be borne in mind for future treatment if the retention of full crowns on the vital teeth is not sufficient. The teeth chosen for treatment initially were the four upper and four lower incisors to improve the appearance, together with the first molars, to maintain the vertical dimension. All the other teeth will be crowned when desirable at some future date.

**TECHNIQUE.**—The remaining enamel on the upper and lower incisors, the three first permanent molars, and the left upper second molar was removed with a diamond instrument to form a collarless jacket crown preparation. In the lower teeth two pins were used, one labially and one lingually. In the upper teeth three pins were used, one mesially, one distally, and one palatally (Fig. 4). The pins used were gauge 23 platinum-iridium wire, which fit snugly into a hole made by a  $\frac{1}{4}$  rosehead bur. The palatal pins on the upper incisors and on the molars were slightly larger, using gauge 20 wire, which fit a No. 1 rosehead bur. The sequence of treatment was to complete the right upper and lower molars first; then the left upper and left lower molars; then the upper incisors; and lastly the lower incisors. In all, twelve crowns were fitted. The technique used was to insert the pins in the teeth and take an elastic 55 impression over the whole area. Small metal sleeves, the same length as the pins in the teeth, were inserted on the pins in the impression and a stone model cast. Cast gold thimbles were constructed for the anterior teeth and acrylic jacket crowns made to fit over the gold. The molar teeth were crowned with gold, using four pins into the dentine of each tooth for retention. All the crowns were fitted without difficulty (Fig. 5). One lower incisor crown was dislodged after two weeks, so a second one was constructed with the pins slightly deeper into the tooth.

### DISCUSSION

The principal purpose of this communication is to show how it is possible to restore aesthetically and functionally a dentition severely affected by this condition, and no attempt has been made to review the subject.

In the treatment of these cases it is important to have a complete plan of action first after a careful assessment and analysis. It is important to maintain the vertical dimension first by placing gold onlays on the first permanent molars. In improving the aesthetics of a patient's teeth, the first consideration must be given to the biological problems involved. The aesthetics can only be improved

if the whole mouth and mechanism of occlusion are taken into account. If only the anterior teeth are crowned, the wear on the posterior teeth will continue to such a degree as to cause the full load to be taken on the anterior teeth, which will eventually precipitate fractures of the crowns. If the treatment is not lasting, then it is unsuccessful.

The case is of interest in that clinically it appeared to be an amelogenesis imperfecta, whereas histologically and radiographically it was diagnosed as dentinogenesis imperfecta. However, in view of the condition of the brother, it would appear to be a reasonable possibility that this case presents features of both abnormalities and that there is a disarrangement of the whole tooth.

**Acknowledgements.**—I am grateful to Professor A. E. W. Miles for the histological reports and to Mr. Broadberry, of the London Hospital Photographic Department, for the photographs.

### BIBLIOGRAPHY

- DARLING, A. I. (1956), *Proc. R. Soc. Med.*, **49**, 759.  
 GATES, R. R. (1946), *Human Genetics*. New York: Macmillan.  
 STONES, H. H. (1951), *Oral and Dental Diseases*. Edinburgh: Livingstone.  
 WEINMANN, J. P., SVOBODA, J. F., and WOODS, R. W. (1945), *J. Amer. dent. Ass.*, **32**, 397.

### Posterior Movement of Buccal Segments

A fixed appliance technique for the posterior movement of upper premolars and molars is presented. Anterior teeth are positioned with cervical anchorage. Upper second molars are not extracted until there is evidence of relapse and this occurs in about 3 per cent of cases.—GUERRERO, JAMES J. (1959), *Amer. J. Orthodont.*, **45**, 125.

### BACK NUMBERS

The Publishers would be glad to purchase copies in good condition of Vol. IX, No. 2, October, 1958.



## NEW MATERIALS AND APPLIANCES

THE new materials and appliances briefly reported here have recently become available to the profession. For further information the reader should write direct to the manufacturer.

### Ultrasonic Cleaning Equipment

ULTRASONIC cleaning equipment for surgical and medical instruments is now available. Cleaning is normally carried out with water only, but weak acid mixtures or mixtures containing surface wetting agents can also be



used. The ultrasonic energy at varying frequencies and power levels from 500 watts to 2 kW. is introduced directly into the cleaning fluid, causing a vigorous action of the surfaces to be cleaned. (Kerry (Ultrasonics) Ltd., Grange Road, Leyton, London E.10.)

### Ligature Cutting Pliers

THE Ash tungsten carbide ligature cutting pliers are designed for use in the mouth, cutting all gauges of wire up to 5 mm., hard and soft. Price: £3 10s. 6d. in U.K. (Amalgamated Dental Trade Distributors Ltd., London W.1.)

### Paper Towels and Dispensing Cabinets

THREE types of Hi-dri paper towels and dispensing cabinets are available. In roll form they are 9 inches wide by 250 feet in length.

The C-fold towel is an individual towel dispensed from a cabinet with a capacity for 250 towels. Double-width towels are made for use in canteens, kitchens, and hospitals.



Cream enamel cabinets are supplied on loan, and installation service is free. (Kimberly-Clark Ltd., Larkfield, Maidstone, Kent.)

### New Toothbrush Design

A SPA Bristle No. 1 toothbrush is of new design with high quality Chungking bristle tufts. The handle is larger than the average



toothbrush, in order to enable a firmer grip to be obtained. The quality and length of the bristle are designed to allow comfortable gum massage. (Spa Bristles Ltd., Chesham, Bucks.)

## MODERN MEDICINE

### EXTRACTS OF PARTICULAR INTEREST TO THE DENTAL PRACTITIONER FROM THE MEDICAL PRESS

#### Diabetes Mellitus

THE diabetic patient is of significance to the dental surgeon, either in relation to the oral conditions he may exhibit or to the special problems he presents in anaesthesia and surgical interventions.

The introduction of insulin in treatment represented a notable landmark in medical progress although its mode of action, in spite of considerable research, is still not clear. Oakley and Nabarro review the modern drug treatment of diabetes.

Less than 50 per cent of patients with diabetes mellitus need insulin for the control of their condition and apparently the remainder have no true deficiency of this hormone. Clinically, therefore, diabetics may be divided into two groups: the thin patients who are insulin deficient and who quickly become ketotic in the absence of insulin treatment; and the obese patients, or those who have been obese, who have a raised blood-sugar and glycosuria, but do not show a tendency to develop ketosis. It is suggested that the latter group are not insulin deficient, but rather insulin resistant. The insulin resistance of the overweight diabetic is apparently related to the obesity and if reduction in weight can be achieved by a suitable diet, low in calories and carbohydrates, the symptoms usually disappear and blood-sugar levels often return to normal.

Many patients find it difficult to keep to a restricted diet. This might be due to economic reasons, as such diets are expensive, or it might be due to the environment or personality of the patient. In selected cases the appetite might be controlled by drugs such as dexamphetamine. Whilst symptoms usually disappear on a restricted diet, the diabetes is not cured, and should the patient's weight go up again the symptoms reappear. About 15 per cent of these obese diabetics continue to show a high blood-sugar despite reduction of

weight to an average level or even below. They seldom exhibit symptoms of diabetes, but the glycosuria and raised blood-sugar persist. A high blood-sugar might lead to retinitis, impaired renal function, or arterial disease, and its reduction is required, therefore, to prevent the development of such complications.

Until recently the only way to lower the blood-sugar was to give daily injections of insulin, but with the introduction of certain hypoglycaemic sulphonamide derivatives, such as tolbutamide, alternative drugs administered by mouth have become available. These compounds lower the blood-sugar in normal subjects and in some diabetics. Their mode of action is uncertain, but they are not to be regarded as "oral insulin preparations". They lower the blood-sugar only if the patient's pancreas is capable of secreting some insulin, and it is likely that they increase the output of insulin by the pancreas and potentiate its action on the enzyme systems of the liver with reduction of hepatic glucose output.

It is important to recognize, however, that the metabolic disturbance in diabetes is not merely an increase in blood-sugar, and these sulphonamide derivatives are, therefore, referred to as hypoglycaemic and not as anti-diabetic drugs.—OAKLEY, WILFRED (1959), *Brit. med. J.*, 1, 1291; NABARRO, J. D. N. (1959), *Ibid.*, 1, 1466.

#### Sleep for your Joints' Sake

When up and about we have to endure the constant compressional influence of gravity which makes all weight-bearing joints of the body fit tighter and closer together. The effect of gravity is at its maximum when standing.

As the dentist's work is usually carried out standing, it is important to remember a few facts regarding the joints and muscles that give us the right balance.

The effect of gravity is further accentuated by the fact that we have to balance on our two feet, and do not stand like a statue on a plinth. This means that every time one bends, or even lifts an arm, the centre of gravity is shifted and various muscles have to contract to counterbalance, thus increasing the overall compression through the spinal column. If the movements are carefully analysed on mechanical principles, it will be realized that the entire framework is being tightened up by all movement operated in the vertical position. No wonder the common complaint of backache is more marked in our profession than in any other. It is, therefore, important to lie down and relax.

When one is lying down the force of gravity passes through the body at right angles to its vertical axis, and is in line with the plane of movement of most joints. The effect of this is gently to separate the bones, increasing the space slightly between them and expanding each joint as a whole. This is very important for requirements like the nutrition of joints and the maintenance of normal expansibility of the whole skeleton, while in active usage. The flatter, the smoother, and the firmer the surface on which the body is lying, the better this stretching and expansion effect is developed. If, however, the surface on which we are lying is soft and yielding, thus moulding itself to the contours of the body, the stretching effect is much diminished and is replaced by a series of very light pulls in adjacent sectors.

The expansion of body joints when lying down is not instantaneous. Time has to take a hand in the process. The more tired, the more rigid, and the older we are, the longer it takes to achieve maximum intensity. When sleep finally intervenes, and full relaxation is developed, then all joints are probably at their greatest expansibility.

Because of the curves and contours of the human body, if we were to remain asleep for hours in one position, some joints would become more stretched than others. Some may even be over-stretched, a thing which is peculiarly detrimental to a joint. Nature has provided us with a system of unconscious

alarms which operate constantly while we are asleep. These cause us to turn about from time to time so that eventually every part of our skeletal framework gets effectively stretched and relaxed alternately.

It is this alarm system which man has most abused by inventing over-comfortable beds. If the bed is much too soft the alarm signals fail to give their usual warning and some joints and muscles are going to get repeatedly over-stretched, with very adverse results. But in addition to mattresses being too soft and yielding, the bed springs can also be too flexible. This results in the bed assuming the contours of a hammock with a deep sag coinciding with the heaviest portion of the sleeper's anatomy.

Joints strained in sleep are certainly no illusion. They do exist. Its adverse influence is measured in months not days. Chronic joint strain can be induced by many types of bed furniture besides beds. The bedding was selected as an illustrative example because it is one of the worst offenders.

What happens to joints strained in this manner is somewhat complicated to explain. Broadly speaking, the effect on the joint is that it becomes unstable and some of its soft active tissues become over-stretched and atrophied while others become fibrosed or hardened. Usually the joint begins its abnormal changes by getting chronically swollen.

Over-stressed tissues "leak" body fluids and these, being rich in certain constituents like fibrin, lay the foundation of adhesions and other thickening-processes of a degenerative nature. The ideal bed is, therefore, one that is absolutely flat when the sleeper is lying upon it. It need not be hard, but the mattress must be on a level surface.

The texture of the mattress is something of individual choice and the resilient foam rubber mattresses are perfectly satisfactory provided they are laid over a firm surface which does not sag in length or breadth. For experiment, put a good foam rubber mattress on the floor and you will see for yourself what the ideal bed should really look and feel like.—MILLER, R. F. (1959), *Your Health*, No. 5, pp. 38-41.

## BOOK REVIEWS

**ORAL HISTOPATHOLOGY.** A Manual for Students and Practitioners of Dentistry. By MARTIN A. RUSHTON, M.A., M.D., Odont.D., F.D.S. R.C.S. (Eng. and Edin.), Professor of Dental Medicine, University of London; and BRIAN E. D. COOKE, M.R.C.S., L.R.C.P., F.D.S. R.C.S. (Eng.), Reader in Dental Medicine, University of London.  $8\frac{3}{4} \times 5\frac{3}{4}$  in. Pp. 190 + viii, with 214 illustrations. 1959. Edinburgh and London: E. & S. Livingstone Ltd. 30s.

THE publication of a new British text-book on a dental subject is a by no means common event, and is certainly one which excites the interest and hopes of teachers as well as the taught. The authors in their preface wisely point out the limitations imposed, principally by the modest size of their book. Their expressed aim is to say what is happening at a cellular level in the principal disorders of the teeth and neighbouring parts and not to explain or discuss in detail, what is perhaps even more important, how these things happen. In consequence the book tends to be informative and classificatory rather than explanatory.

On first glancing through, this book creates an extremely favourable impression; it is generously interspersed with excellent photomicrographs of material which has been carefully selected, the layout of the pages is very pleasing, the general plan of the book is excellently conceived, and the bibliographies at the end of each section are very well chosen and will serve admirably to lead the zealous student to the original sources of information. It is necessary to say, however, that on closely reading the text an unevenness in the quality of the writing is discernible. The reviewer found much pleasure in the faultless style of such sections as that dealing with trauma to developing teeth, but other passages, such as page 131, would not serve as examples of good descriptive or scientific English. What appear to be two errors of fact, from which quite understandably few first editions of text-books are entirely free, may be indicated. It would be more accurate to qualify a statement

on page 161 by the addition of the word "sheath" so that it would read, "The neurofibroma is a tumour that arises from all the sheath elements of a peripheral nerve". The statement (page 165), "Other hæmangiomas are just vascular reparative tissue or highly vascular connective tissue" may mislead students who would be likely to fail to appreciate that "supposed hæmangiomas" are referred to.

This is a book which can be expected to achieve a second edition in the near future, when not only could such imperfections as the book possesses be easily removed but it is to be hoped it would be possible for the authors to enlarge its scope.

A. E. W. M.

**TECHNIQUES MODERNES D'UTILISATION DES MATÉRIAUX À EMPREINTES EN PROTHÈSE FIXE.** By J. POGGIOLI, D.D.S., Professeur Adjoint at l'Institut de Stomatologie de la Faculté de Médecine de Paris. With the collaboration of P. LAUDENBACH, R. LEIBOVICH, B. MENG, and P. MORIN.  $8\frac{1}{2} \times 5\frac{3}{4}$  in. Pp. 193 + viii, with 140 illustrations. 1959. Paris: Masson et Cie. 2500 francs.

PROFESSOR Poggioli has produced a concisely written monograph on methods and materials used in crown and bridgework at a time when text-books on the subject are tending to discourage all but the most devoted student because of their inordinate length. It is, therefore, especially welcome.

The author begins by mentioning briefly the various materials used for taking direct and indirect impressions in crown and bridgework. He divides these into two groups, the rigid and the non-rigid. In the first group he includes wax and composition, and in the second alginates, reversible hydrocolloids, and the rubber-base materials. The wax impression techniques are then described in detail, and causes for inaccuracies in the end-product are suggested. The copper ring and composition impression technique follows, and a note is

added on electroplating such an impression. Then follows a description of the various techniques for using the non-rigid materials, and reference is made to the dimensional changes that may take place during and after the impression has been taken and to the need for using a special tray. A description of how these materials may be electroplated is given, with special reference to the rubber-base materials.

The style throughout is economical and the diagrams are clear, self-explanatory, and simple. The material is presented systematically and the clarity of expression deserves considerable praise. This monograph contains information both scientific and practical and includes a bibliography with a full coverage of European and American literature. It should be of considerable value to the dentist and dental technician alike, and merits an English translation.

J. M. J. L.

#### CONDUCTION, INFILTRATION AND GENERAL ANESTHESIA IN DENTISTRY.

By the late MENDEL NEVIN, D.D.S., and MARSHALL I. NEVIN, M.D., F.C.C.P. General Anesthesia Section by JULIOUS R. BOURGOYNE, B.S., D.D.S. 6th Edition. 9 x 6 in. Pp. 392 + xxiii, with 240 illustrations. 1959. Brooklyn, N.Y.: Dental Items of Interest Publishing Co. Inc. (London: Henry Kimpton.) 63s.

With the publication of this sixth edition the authors can claim that nearly fifty thousand copies of this book have been sold and twenty printings required. Such a record is testimony of the high regard which members of the profession have for this work. It probably also accounts for the price which, by to-day's standards, is modest.

Only the minimum material necessary for a proper understanding of the subject is included in the sections on the history of anaesthesia, anatomy, and pharmacology. This has made it possible for the technical minutiae of injection technique to be described without making the text tedious to read.

Readers in this country will find some differences between certain methods and terms used by the authors and those current

here. For example, the local injection of penicillin solutions into the oral tissues is not taught over here. Only the administration by deep intra-muscular injection away from fat and major nerves is advocated by us. Again on page 310 apomorphine is mentioned as a drug for premedication, though its narcotic properties are small and its usual use is as an emetic!

It is presumed that the chapter on stages and signs of anaesthesia describes those seen during nitrous oxide-oxygen anaesthesia, though this is not made clear. Some of the signs described are due to oxygen lack. The recognition of the signs of oxygen lack is important and it would make the matter clearer to students if the classical signs of anaesthesia were described, then the signs of oxygen lack, and finally the possible effects of nitrous oxide-oxygen administration. Again, the third stage of anaesthesia is only divided into three planes in this book, whereas in the classical description based on ether administration and without anoxia, four are described.

One small error has crept in. Figure 52 illustrates the posteria-palatine injection instead of the tuberosity injection. These comments apart, this is as good a book as its record suggests and can be recommended.

G. R. S.

#### DENTAL-MEDICAL EMERGENCIES AND COMPLICATIONS.

By IRA JAY BERLOVE, D.D.S., M.D., F.A.C.D., F.I.C.S., Attending Surgeon and Chief of Maxillo-facial and Oral Surgery Service, Misericordia Hospital, New York. 7 $\frac{3}{4}$  x 5 in. Pp. 380. 1959. Chicago, Illinois: Year Book Publishers Inc. (London: Interscience Publishers Ltd.) 57s.

THE term "emergency" is usually associated with a condition that may endanger the human life. Although an emergency can and does arise in dentistry, it is not frequent and seldom demands extreme and immediate measures to save a patient's life. Complications, however, can be very common.

When an emergency is encountered, the knowledge to diagnose and treat such a condition is most valuable. Calmness, efficiency, promptness, and intelligence are



foregone qualities of a dental or medical practitioner who will be called upon to act in a crisis. In a book such as this one under review, exact and pre-gathered information for all types of exigencies and complications in dental practice are assembled for the benefit of the dental and medical professions. Under the following five major headings, the emergencies and complications are discussed: (1) Pain; (2) Anæsthesia; (3) Surgery; (4) Hæmorrhage; (5) Medical complications.

Although sole use of intravenous anæsthesia is to be deprecated in routine dental surgery, its use as a small induction dose prior to nitrous oxide and oxygen administration is safe and practical. It must be borne in mind, however, that any drug proclaimed to be safe may turn the tables if it is mishandled in any way. There are one or two conditions such as cheilitis, mucous cysts, etc., mentioned in the book which cannot be classified as either medical or dental emergencies, yet it is interesting to note various points about them. Relevant subjects such as the taking of biopsies and purely medical conditions, which may be confronted in a dental surgery, are worth including as it helps to form a true

perspective of difficulties that are met with in daily routine dental practice or in a specialist service.

Under the treatment of respiratory failure the words "artificial respiration must be given at once" are mentioned, but this is not enough to save a life as many do not know how to give such an aid. There are several methods, and at least one of them should be described with actual photographs or line drawings.

Under emergencies following injection of local anæsthesia several conditions are mentioned, some of which can also occur following a general anæsthetic, but they are not stated. Surgical removal of a broken needle under fluoroscope as recommended in the book is to be deprecated as it may prove one of the hazards of roentgenology.

No one should be without this book if he is to be prepared to act in a dental-medical emergency, whatever the cause. The book is well produced, and its value would be enhanced if a few photographs were included to liven the pages of this useful and practical treatise on dental-medical emergencies and complications.

H. M.

## LETTER TO THE EDITOR

August 18, 1959.

Dear Sir,

With reference to your editorial on polishing amalgams, I think that you have been less than fair. First, it is by no means proven that polishing amalgams is indeed advantageous. We know that you cannot polish an amalgam in inaccessible parts and that electrolytic action may occur between different parts of the restoration. We are also very seriously ignorant of the effect of surface changes which occur during polishing. Moreover, a polished restoration will soon lose its polish if a typical toothpaste is vigorously applied.

Granted the restoration must have a smooth finish if possible, but how smooth to be both practical and beneficial is not yet known.

Further, I would point out that where a mouth can be decently restored (for reasons of sheer pride of workmanship) I frequently will set to and polish. But where, whatever one does, the mouth or the patient's care of the mouth, or both, do not come up to standard, then surely the effect of polishing is entirely academic.

Yours faithfully,

GEORGE E. RAY.

86 Whitelands Avenue,  
Chorleywood,  
Herts.

## ANGLO-CONTINENTAL DENTAL SOCIETY Autumn Meeting, 1959

THE title of the Meeting as a whole will be "Symposium on the Child Patient". On Friday, October 30, at 6.30 p.m., at the Royal Society of Medicine, 1 Wimpole Street, W.1, Mr. H. S. M. Crabb, B.D.S., M.D.S., F.D.S., Ph.D., of Bristol University, will speak on "The Approach to Dental Education of Parent and Child". On the Saturday morning at the Royal College of Surgeons the first lecture, at 10 a.m., will be given by Dr. R. MacKeith of Guy's Hospital, as a pædiatrician; he will be followed by Dr. H. Edleston of Leeds, as a psychiatrist, on "The Anxious Child". At the Cora Hotel on the Sunday morning Messrs. J. Kurer and W. Grossmann will lecture on "The Deep Cavity" and "Preventive Orthodontics" respectively.

The dates of the Spring Meeting 1960 are April 29, 30, and May 1.



## THE RELATIONSHIP BETWEEN SPEECH, TONGUE BEHAVIOUR, AND OCCLUSAL ABNORMALITIES

By PETER BLYTH, L.D.S., D.Orth., R.C.S. (Eng.)

*Institute of Dental Surgery, The University of London, Eastman Dental Hospital*

THIS paper deals with one aspect of speech only, namely lisps or sigmatisms, and I shall endeavour to demonstrate that a relationship exists between this defect and certain of the problems which confront us as orthodontists.

It is generally accepted that dental irregularities are not a direct cause of a sigmatism, and that where the two are present in an individual case some common cause must be found. Froeschels (1937) found that sigmatism was due to tongue position and activity and not due to malocclusion. In 1935 Van Thal examined 180 children undergoing orthodontic treatment at the Royal Dental Hospital, and found that slight deviations in defective "s" and "z" sounds were not more common in these children than in controls with normal dentition. She excluded those cases attending the speech department. Van Thal (1954) asserts that a tongue-thrusting swallowing behaviour may be associated with an interdental sigmatism, but not necessarily so, and that other factors such as psychological ones must be considered.

I am not able in this paper to give a complete review of the literature, but I would just like to report Bernstein's (1954) conclusions on the relationship of speech defects and malocclusion.

1. Children with speech defects do not have a greater amount of malocclusion than children without speech defects.

2. Speech defects are not related to malocclusion generally except in the classification of open bite.

3. In this classification there is a strong relation to lisping.

4. The severity of the lisp does not vary with the amount the bite is open or with the amount of overjet or overbite.

The most interesting and valuable work of Hopkin and McEwen, presented before this Society (1955, 1957), supports the view that, in general, speech defects are as likely to be found with normal occlusions as with malocclusions. No definite relationship between tongue behaviour and lisping was established by them and they felt that further investigations were needed.

I want first of all to report the results of an investigation of 200 children carried out at the Eastman Dental Hospital, London. It is important to realize that they were all attending the orthodontic department, and that they were, therefore, not representative of the child population as a whole. The clinical details of the malocclusion and tongue behaviour were taken from the original diagnosis made by either Professor C. F. Ballard or Mr. S. G. McCallin. The speech was evaluated quite separately by Miss E. K. Bond, Speech Therapist attached to the hospital. Before looking at the results I should state that an atypical swallow was defined as a tongue-thrusting swallow. The initial diagnoses were made at a time when there was no attempt made at differentiating between an "endogenous" tongue thrust—that is, one which is inborn and constituting a primary aetiological factor—and one which was secondary to other factors. I shall return to this question of swallowing behaviour later. Sigmatisms were divided into interdental sigmatisms, with the air escape anteriorly, and lateral sigmatisms, with a lateral air escape. The lateral sigmatism is much less common; the tongue is in contact anteriorly with the palate and incisors as in forming the letter "L". The sides of the tongue are down and not in contact with the teeth and palate, so that there is a lateral air escape.

Given at the meeting held on March 9, 1959.

Amongst other things, I wanted to find out whether the basic position of the tongue in relation to the incisors, as opposed to any abnormal behaviour pattern of an endogenous nature, had any aetiological significance in the production of a sigmatism. I also wanted

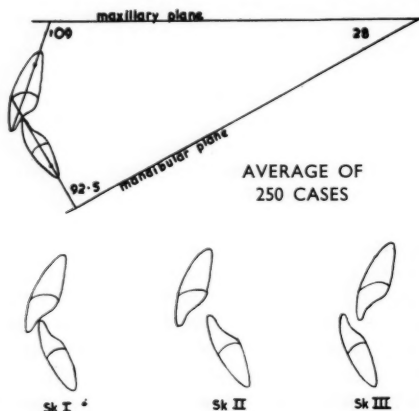


Fig. 1.—Assessment of skeletal pattern.

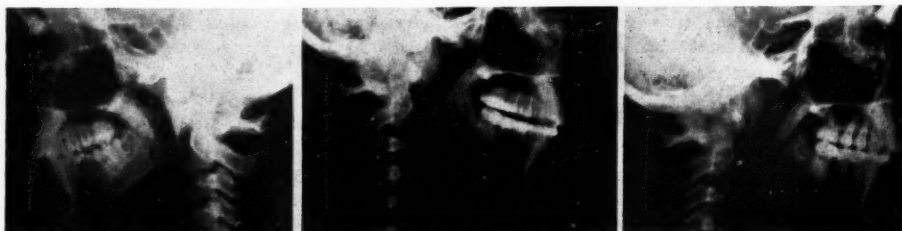


Fig. 2.—Cephalometric X-rays showing low tongue position.

to know whether an "ad-dental" sigmatism, where the tongue is pressed hard against the incisors, and produces a "th" sound, was necessarily accompanied by a tongue thrust, and whether this type of sigmatism had any different prognosis from an "air escape" interdental sigmatism. This question was not answered in the Eastman analysis, because this preliminary investigation did not recognize such a type. I felt that if we could differentiate between sigmatisms due to *position* of tongue, and those due to *function* of tongue, we might be in a stronger position to give a more accurate prognosis, both for the cure of the sigmatism and also for the correction

of the malocclusion. Finally the importance or otherwise of lateral sigmatism seemed to merit investigation.

Tongue position was analysed in an antero-posterior direction by determining the dental base relationship. From the initial cephalometric X-rays of each case, conversion tracings were prepared according to the method advocated by Ballard (1951); from these, each of the 200 cases was typed as Skeletal I, II, or III, and it was felt that this would indicate the basic position of the tongue in relation to the maxillary arch (Fig. 1).

Analysis of tongue position in a vertical direction was carried out by two means: first, it was felt that the maxillary-mandibular plane angle itself might indicate to some extent the position of the tongue in relation to the maxillary incisors, and secondly the height of the tongue above the occlusal plane was noted. The X-rays were examined and the tongue position carefully assessed. Where the tongue did not completely fill the "inter-maxillary space" its height above the occlusal

plane was noted. The resting position of the tongue above the occlusal plane is fairly constant, and Fig. 2 shows three X-rays taken of the same patient at different times.

I have explained how swallowing and speech were assessed; the occlusion was a record of the incisor relationship.

## RESULTS

**1. Skeletal Analysis.**—Table I shows the skeletal analysis according to the method elaborated above, together with the maxillary-mandibular plane angles.

There are 52 interdental and 10 lateral sigmatisms, and as I felt that different

mechanisms would be at work I have analysed them separately. The 52 interdental sigmatisms are split up as shown in Table II.

Table I.—SKELETAL ANALYSIS (200 Cases)

Sk. I: 67 or 33.5 per cent	} 66.5 per cent
Sk. II: 96 or 48 per cent	
Sk. III: 37 or 18.5 per cent	

*Maxillary-Mandibular Plane Angle*

Average for the whole group is 28.93°

Average for the separate skeletal groups:

Sk. I: 28.36°

Sk. II: 29.81°

Sk. III: 27.01°

Table II.—INTERDENTAL SIGMATISMS (52 Cases)

Sk. I: 13 or 25 per cent (33.5 per cent)	} 66.5 per cent
Sk. II: 30 or 57.69 per cent (48 per cent)	
Sk. III: 9 or 17.3 per cent (18.5 per cent)	
Abnormal bases	Interdental sigmatisms on abnormal bases
66.5 per cent	75 per cent

Table III.—TONGUE POSITION ANALYSIS

Total Group of 200	106
	<i>Low Tongues</i>
Interdental sigmatisms	26 per cent
Abnormal swallows	44.5 per cent
Maxillary-mandibular plane angle	28.93°
	30.19°

There is, therefore, a greater number of interdental sigmatisms on an abnormal base than we would expect to find if they were distributed at random. The main increase is on the Class II dental base. This fits in with Leech's findings (1958). Anteroposterior position of the tongue therefore appears at this stage to be a factor in the aetiology of the interdental sigmatism.

Now consider the maxillary-mandibular plane angle. The mean angle for the 52 interdental sigmatisms is 30.6°, and you may remember that the average for the whole group of 200 cases is 28.93°. In view of the fact that the 52 sigmatisms had different

percentages of the various skeletal patterns from the total group of 200, and to obviate the possibility that a higher percentage of Skeletal II bases (with a higher average maxillary-mandibular plane angle) might in any case produce such a higher angle for the 52, a "corrected" maxillary-mandibular plane angle for 52 cases was worked out. This used the percentages of skeletal patterns of the sigmatism group with the individual average figures found from the total group. The "corrected" angle was found to be 28.95°, so that the figure of 30.6° is still high.

Lest it be felt that this figure was not significantly higher, and to help eliminate the possibility that a very few high angles had unduly coloured the sigmatism group, a further small analysis was made. If the 52 had a generally high maxillary-mandibular plane angle, there should be a greater number of sigmatisms in the high maxillary-mandibular plane angle cases than there were in the low. This proved to be the case.

Of the cases with maxillary-mandibular plane angles of 29° or over, 32.9 per cent were interdental sigmatisms; 22.1 per cent of the cases only were sigmatisms where the angle was below 29°.

I use the figure 29° because this was approximately the average for the whole group of 200.

There is, therefore, a correlation between the maxillary-mandibular plane angle and an interdental sigmatism.

**2. Relation of Tongue to Occlusal Plane.**

There were 106 cases where the tongue did not completely fill the intermaxillary space. This was over half, and the average maxillary-mandibular plane angle was 30.19°. This was an expected result; we like to think that the higher maxillary-mandibular plane angles indicate a lower tongue-resting position. Was there, however, a correlation between this low tongue position and interdental sigmatisms?

Table IV.—RELATION OF SIGMATISMS AND ABNORMAL SWALLOWS TO OCCLUSIONS

	Occlusion (200)	Sigmatisms (52)	Abnormal Swallows (88)
	per cent Nos.	per cent Nos.	per cent Nos.
Cl. I (29.2°)	28.5 (57)	19.23 (10)	19.3 (17)
Cl. II, div. 1 (29.9°)	48.5 (97)	67.2 (35)	65.9 (58)
Cl. II, div. 2 (24.48°)	12.5 (25)	3.8 (2)	6.8 (6)
Cl. III (28.16°)	10.5 (21)	9.6 (5)	7.9 (7)

Although *Table III* shows a slight increase in interdental sigmatisms in the low tongue position group, this is probably accounted for by the higher average maxillary-mandibular plane angle. The figures do not indicate a preponderance of low tongue-resting positions in the interdental sigmatism group.

**3. Occlusal Patterns.**—Examination of the occlusal relationships gives us some most interesting information.

*Table IV* compares the percentages of the different occlusions in the total group with those in the sigmatism group, and shows also the distribution of the abnormal swallows. In brackets may be seen the average maxillary-mandibular plane angles of the different occlusions, and I would ask you to make special note of the differences.

Here we see a very much higher percentage of interdental sigmatisms in Class II, division 1 occlusions than we would expect to see, and a correspondingly high percentage of abnormal swallows. It would not be correct to deduce from these figures that the Angle Class II, division 1 incisor relationship itself is an important factor in the production of an interdental sigmatism. Most of the sigmatisms are accompanied by an abnormal swallow, and we do know that tongue-thrusting swallows, in association with other morphological factors, are important in the aetiology of Class II, division 1 incisor relationships.

Discarding sigmatisms for the moment, I have prepared a table analysing the different occlusions according to the skeletal patterns (*Table V*).

*Table V.*—DIFFERENT OCCLUSIONS ON THE THREE SKELETAL PATTERNS

		per cent
Sk. I 33.5 per cent of the 200	Angle Cl. I	46.26
	Angle Cl. II, div. 1	38.8
	Angle Cl. II, div. 2	11.9
	Angle Cl. III	2.9
Sk. II 48 per cent of the 200	Angle Cl. I	12.5
	Angle Cl. II, div. 1	70.8
	Angle Cl. II, div. 2	16.6
	Angle Cl. III	—
Sk. III 18.5 per cent of the 200	Angle Cl. I	37.83
	Angle Cl. II, div. 1	8.1
	Angle Cl. II, div. 2	2.7
	Angle Cl. III	51.35

You will remember that the 52 sigmatisms showed a higher percentage on Class II dental bases (57.69 per cent as compared to 48 per cent). Can we not say that this is due, not to the base itself, but to the fact that the Class II dental base contains a very much higher proportion of Angle Class II, division 1 cases? You will see that there are almost twice as many Class II, division 1 incisor relationships on the Class II dental base as on the Class I. We have already shown that the majority (67.3 per cent) of the interdental sigmatisms are related to Angle Class II, division 1 occlusions.

Endeavouring to show that this assumption is correct, I worked out the following:—

1. The total Angle Class II, division 1 occlusions on each of the three skeletal bases.
2. The total Angle Class II, division 1 occlusions with interdental sigmatisms on the three bases.
3. The total Angle Class II, division 1 occlusions without interdental sigmatisms on the three bases.

*Table VI* shows the result. The three groups of figures on the right-hand side are very nearly identical, and there is no evidence of a higher Skeletal II base percentage with interdental sigmatisms.

Reviewing the whole question of tongue position and maxillary-mandibular plane angle in relation to the interdental sigmatisms, it can be shown that the high correlation between these sigmatisms and Angle Class II, division 1 occlusions will account for almost all the earlier "skeletal" findings.

Angle Class II, division 1 occlusions have an average maxillary-mandibular plane angle of 29.9°, which is probably not significantly

*Table VI.*—BREAKDOWN OF ANGLE CLASS II, DIVISION 1 OCCLUSIONS

	per cent
1. Angle Cl. II, div. 1 occlusions (total)	Sk. I 26.8
	Sk. II 70.1
	Sk. III 3.1
2. Angle Cl. II, div. 1 with interdental sigmatisms	Sk. I 28.5
	Sk. II 68.5
	Sk. III 2.8
3. Angle Cl. II, div. 1 without interdental sigmatisms	Sk. I 27.2
	Sk. II 69.3
	Sk. III 3.3

lower than the 30.6° on the interdental sigmatism group. There were approximately 17 per cent more Class II, division 1 occlusions in the high maxillary-mandibular plane angle group than there were in the low group.

In concluding this section on interdental sigmatisms we can be fairly certain that:—

1. The skeletal morphology has little, if any, influence in the production of such a sigmatism. Compensatory movements of the tongue and the mandible have been described by several workers: Rathbone (1955), Ballard (1957), Benediktsson (1958), Morley (1957); and these take care of any skeletal discrepancies.

2. There is an extremely close relationship between Angle Class II, division 1 occlusions and both interdental sigmatisms and abnormal swallows. This statement must not be misinterpreted. It is not the incisor relationship itself which is the cause of the speech defect, but rather the tongue behaviour with which it is associated, and we do know that the latter may well be one of the aetiological factors in producing a Class II, division 1 incisor relationship. In support of this one must realize that almost two-thirds of the Class II, division 1 incisor relationships are not accompanied by an interdental sigmatism.

### LATERAL SIGMATISM

There were only 10 lateral sigmatisms and Table VII illustrates the skeletal and occlusal distribution. It is difficult to read much from these figures because of the small numbers, but I would ask you to look at the large number of Angle Class II, division 2 occlusions associated with a lateral sigmatism—4 out of 10—whereas Class II, division 2 occlusions form only 12.5 per cent of the total of 200. The low maxillary-mandibular plane

Table VII.—LATERAL SIGMATISMS

Sk. I	2
Sk. II	6
Sk. III	2
Angle Cl. I	2
Angle Cl. II, div. 1	3
Angle Cl. II, div. 2	4
Angle Cl. III	1

Average maxillary-mandibular angle 27.5°  
Low tongue position in 1 only

angle is entirely accounted for by this preponderance of Class II, division 2's. Frank (1955) states that an open bite in the posterior segment may result in the lateral type of lisp. I think that the common denominator here may be either an increased interocclusal clearance, or the low postural position in Class II, division 2's, described by Ballard (1956).

I want now to turn from this cross-section analysis and consider the longitudinal problem. Three statements may be made at this stage:—

1. Some sigmatisms improve spontaneously without any relation to treatment, either orthodontic or speech correction.

2. Some appear to improve when the incisor positions improve.

3. Some respond easily to speech therapy, and some are intractable.

Are we able to differentiate between these types at the diagnostic stage, so that we can give a more accurate prognosis both for the sigmatism and the malocclusion, bearing in mind the close correlation between interdental sigmatisms and atypical tongue behaviour? I think we can make some headway towards this goal, and would like to present some case histories.

It must be realized that although speech is normally fully developed at about the age of 5, there is a normal variation. Templin (1957) finds that articulation in general is not essentially mature until the age of 8.

### CASE REPORTS

*Case C. F. (Fig. 3).*—Aged 7 years, 11 months when initial models were taken. She had a tongue-thrusting swallow, sucked her thumb, and had an interdental sigmatism. An Andresen appliance was fitted, and when the second set of models were taken there was no lisp, no thumb habit, and a tooth-together swallow with no tongue thrust.

*Case R. R. (Fig. 4).*—Aged 8 years when the first models were taken. There was a thumb-sucking habit, an interdental sigmatism, and a tongue-thrusting swallow. At the time the second models were taken there was a tooth-together swallow, with no tongue thrust and no sigmatism. Speech had improved measurably within six months of fitting the first appliance.

*Case L. B. (Fig. 5).*—Aged 8 years, 1 month when the initial models were taken. She had a tongue-thrusting swallow and contracted the lower lip under the upper incisors. She had a habit of sucking her lip. There was a lip-to-tongue resting posture, and a sigmatism. The



lips were potentially competent. The second models show the result seven months following discontinuance of the appliance. There is now a tooth-together swallow with no tongue thrust, and no contraction of oro-facial musculature. There is no lip-tongue resting posture and the lips are competent. There is now no lip-sucking behaviour and no sigmatism.

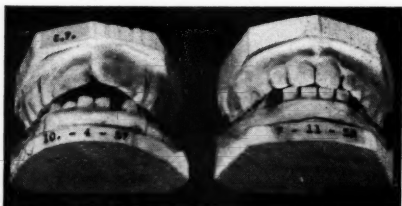


Fig. 3.—Case C. F. Models showing reduction in overbite and over-jet at the end of treatment.

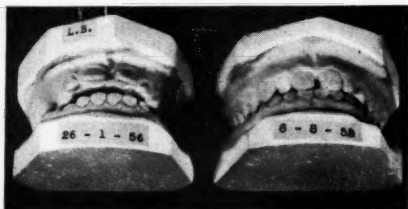


Fig. 5.—Case L. B. The final models reflect the improved tongue behaviour following treatment.



Fig. 7.—Case P. H. The improved vertical relationship of the incisors was not connected with cessation of a sucking habit.

Case E. T. (Fig. 6).—Aged 7 years, 9 months when initial models were taken. The relevant notes from the diagnosis show that there was a tongue thrust on swallowing, with contraction of mentalis and orbicularis oris muscles. There was a tongue to lower-lip resting posture and an interdental sigmatism. The first two fingers of the left hand were sucked persistently. An Andresen appliance was fitted to discourage the habit and try to lessen the ultimate problem. The second models were taken in Jan. 1959, ten months following discontinuance of the appliance. There is now no tongue-lip resting posture, a tooth-together swallow with no tongue thrust. She very occasionally swallows with all the teeth apart, but with no anterior tongue thrust. Some sigmatism remains with some tendency to move the tongue forward during general speech.

16

Case P. H. (Fig. 7).—He was just over 11 when the initial models were taken; there was a marked sigmatism with a tongue-thrusting swallow. There were no secondary sucking habits. The lip was so marked that I advised a course of speech therapy to run concurrently with the orthodontic treatment. However, I didn't get round to



Fig. 4.—Case R. R. The improved incisor relationship is especially apparent in a vertical direction.



Fig. 6.—Case E. T. Models show improvement of anterior open bite during treatment.

organizing this and when the second set of models were taken on Aug. 20, 1958, there was then no sigmatism. A tongue-thrusting behaviour was persisting, however.

Now two cases without sigmatisms.

Case P. R. (Fig. 8).—Aged 10 years, 7 months at time of diagnosis. Marked tongue thrust against contraction of the mentalis during swallowing. Incompetent lip pattern with lower lip to tongue-resting posture. Sucks right thumb. Second models taken Aug. 23, 1958, six months after an Andresen appliance had been discontinued. He does not now suck his thumb, and there is a tooth-together swallow with no tongue thrust.

Case P. B. (Fig. 9).—This patient was 8 years, 3 months when a deterrent plate was fitted to try to overcome a very persistent thumb-sucking habit. There was a tongue-thrusting swallow. This patient had fifteen months of active treatment with this and other appliances, and we had a tremendous job to try to get her to overcome the habit. When the second models were taken there was little or no residual thumb-sucking; there was a normal tooth-together swallow with no tongue thrust.

You will see that in each of these cases (except one) the swallowing pattern appears to have altered. Now I realize that I am not showing you anything new; I am merely trying to demonstrate a possible association of one factor with another.

Each of the foremost workers in this field, Ballard (1955, 1957), Rix (1948, 1953), Hovell (1955), Gwynne-Evans and Tulley (1955) states, or suspects, that some modifications of swallowing behaviour with some types of swallow may occur. Ballard feels that there

during speech, and not just during the production of an "s" sound.

Of the two types of tongue thrust with the posterior teeth in occlusion, one type, the habit activity, may or may not mature to an improved pattern of behaviour. I think



Fig. 8.—Case P. R. Models showing that an asymmetrical open bite, a product of thumb-sucking, has been entirely eliminated.



Fig. 9.—Case P. B. This case is still under treatment, but there is an improved incisor relationship with cessation of the thumb habit.

are two types of tongue thrust: one which is endogenous and remains after treatment, and one which is a habit activity. Because of the relationship with interdental sigmatisms, I thought it would be of aetiological significance if some attempt could be made to differentiate between these types. Hopkin and McEwen (1957) recognized the present confusion on the subject of swallowing, owing to the great amount of study being carried on. Whilst in no way competent to enter this field of orofacial behaviour, I found from the practical point of view that I could detect no fundamental way of differentiating those thrusts which are going to get better anyway and those which were going to remain. Either could be accompanied by an interdental sigmatism and a lip-tongue resting posture. I must admit to being very much more suspicious of a resting lip-tongue contact when *all* the teeth are out of occlusion. I could, nevertheless, detect varying degrees of intensity of the thrust. This, together with the inclination of the upper incisors, the lip pattern and its behaviour during swallowing, plus any skeletal discrepancy, may allow one to assess the relative importance of the thrust. There did appear to be, moreover, two shining lights: first, the presence or absence of a persisting thumb- or finger-sucking behaviour, and secondly, the behaviour of the tongue *in general*

that where a thumb- or finger-sucking habit is persisting, then this serves to delay any maturation that would normally take place. I think also that where an interdental sigmatism is superimposed on this picture, then the development of a normal "s" sound may be delayed in a similar manner. Tongue behaviour appears to improve with the cessation of the thumb-finger habit, and with this improvement goes an improvement in speech. This can, of course, occur without treatment, and in those cases where appliances have been fitted, I in no way attribute the improved tongue behaviour to the appliance directly. The probability is that most if not all of the maturation would have taken place without the appliance. In the case of a child of more mature years, say 8 plus, continuing a severe finger-thumb-sucking habit, and where this is associated with an interdental sigmatism and tongue-thrusting swallow, I think one may be assisting in the process of maturation of speech and tongue behaviour by trying to control the habit.

The use of an appliance in these circumstances will not correct the persistent habit overnight. Where it does correct the habit miraculously then in my opinion it was an error to use it at all. An appliance of any sort designed to accomplish other tooth movements may well act as a deterrent plate.

I do not question the existence of an endogenous tongue thrust, which may or may not be coupled with an interdental sigmatism, and which has a poorer prognosis. It may be that those tongue behaviours not associated in any way with a persisting thumb- or finger-sucking habit have such a relatively poorer prognosis.

There are almost certainly two principal types of interdental sigmatism. I know that many types are described, but I think that in the main these are descriptive terms applied to the resultant sound produced. The great majority of interdental sigmatisms, uncomplicated by other speech defects, improve spontaneously during the growing years. The reason for the fact that many do well during a course of speech therapy is simply that they would have done well anyway.

My card index is replete with cases of both interdental and lateral sigmatisms which have corrected or improved themselves, while I have been waiting to film and record them. With this first type of sigmatism, there is no doubt that once the correct sound has become an integral part of the speech pattern, there is no reversion. This supports the view that the defect is merely a stage in maturation, which may, however, be delayed. The second type constitutes the minority which may persist into adult life, and about which very little is known. These are the ones which are intractable from the speech-therapist's point of view. If a good "s" sound can be obtained by corrective training, then this is probably only maintained by a conscious effort. As Ballard (1955) has stated, the sigmatism tends to return when the individual is under stress or excited. An association with a tongue behaviour where the tongue comes right through between the incisors in speech generally, known as a multiple interdentalism, may well indicate this poorer prognosis.

#### SEVERE LATERAL SIGMATISM

I want now to mention three severe lateral sigmatisms in Class II, division 2 occlusions which have reverted to normal, or nearly normal, speech. Each case had a deep overbite with a wide interocclusal space. This is

associated either with an increased interocclusal clearance or the postured mandibular occlusion described by Ballard (1956).

In each case the lateral sigmatism has improved during the initial phase of treatment when a bite plane was being worn. Each now shows a reduction in the deep overbite without presenting at this stage an increase in the interocclusal space in the buccal segments. It may not be pure coincidence that the above cases showed their improved speech behaviour at the same time as the postured occlusion had been eliminated, but it is sufficiently interesting to merit further and more elaborate investigations.

Table VIII.—BRISTOL SIGMATISMS

Interdental		
Cl. I	5	} Majority with reduced overbite or open bite
Cl. II, div. 1	16	
Cl. III	2	
Lateral		
Cl. I	2	
Cl. II, div. 1	6	
Cl. II, div. 2	4	
Cl. III	1	

I have in Bristol 36 sigmatisms which I have been observing, and they are split up as shown in Table VIII. Careful assessment of the swallowing behaviours indicates that in many interdental sigmatisms the tongue thrust, whilst usually present, is not vigorous; this would agree with the Eastman analysis, bearing in mind that the latter was initiated more than five years ago, when no differentiation of tongue-thrusting swallows was made. Thirteen of my cases of interdental sigmatism were persistently sucking finger or thumb. A larger proportion of lateral sigmatisms was related to Angle Class II, division 1 occlusions than appeared in the earlier Eastman figures.

Before showing a short film, I want to sum up my present thoughts on the inter-relationship of sigmatisms, tongue behaviour, and occlusions:—

1. Skeletal base discrepancy in an antero-posterior direction does not produce an actual increase in sigmatisms, and compensation takes place both by tongue and mandibular movements.

2. We have to be very careful in interpreting the high maxillary-mandibular plane angle

results. Certainly an association is shown between these high angles and Class II, division 1 occlusions. There is also an association between a high angle and a low tongue-resting position; there is further an association between Class II, division 1 occlusions and interdental sigmatisms. But whether there is a cause and effect relationship between a high maxillary-mandibular plane angle and an interdental sigmatism is something we are unable to assess.

3. The importance of the tongue in relation to the occlusal plane is then, to some extent, not resolved. I should like to examine the height of the tongue in relation to the occlusal plane on rest position X-rays.

4. Tongue *function* does appear to be important; some form of tongue-thrusting behaviour does seem to accompany most of the interdental sigmatisms; where a definite "th" sound is produced as opposed to an air escape, it is less likely to be coupled with an atypical swallowing behaviour.

5. Tongue behaviour improves especially when associated with secondary sucking mechanisms, thumb- or finger-sucking, which are brought under control. If there is, superimposed on this picture, an interdental sigmatism, there is a concurrent improvement in speech.

6. A persistence of the thumb- or finger-sucking habit may serve to perpetuate the other disorders. The prognosis for improving an incisor relationship is very much poorer in the face of a continued tongue and thumb behaviour. But this is only at one stage in the development of the occlusion; later on, the prognosis for correction may have improved considerably.

7. One can be less definite about those interdental sigmatisms not accompanied by secondary sucking mechanisms. I have several which have corrected themselves during the course of orthodontic treatment. There are, of course, other aetiological factors which I have not discussed, and which must be taken into account. Deafness and intelligence are also important.

8. Lateral sigmatisms may or may not be associated with a tooth-apart swallow, that

is when all the teeth are out of occlusion, but they are not related to a forward tongue thrust. A lateral sigmatism and a forward tongue thrust present in the same case must be considered quite separately. I have several such cases in Class II, division 1 occlusions, when the tongue behaviour improved as the thumb-sucking habit ceased, the lateral sigmatism remaining. When a lateral sigmatism is associated with a Class II, division 1 occlusion, the cause of the incisor relationship must be ascribed to some other factor than a forward tongue thrust, unless the two coexist.

9. Lateral sigmatisms may often be associated with Angle Class II, division 2 occlusions, but are not necessarily so. The existence of more than one type of lateral sigmatism cannot be ruled out.

10. I make one final point. All our cases should be subject to a period of observation before commencing treatment. We must view them as part of a progressive development, and not as a set of plaster casts. In spite of what has been said above, I do *not* fit a great many deterrent plates or Andresen appliances. If a case under six-monthly review is improving, and any habit gradually being controlled, I am content to discard this aspect of the case and allow further development to take place.

## FILM

The patients were filmed initially to provide a visual record of both tongue and mandibular movements in speech. It is intended to refilm the same patients later, and this will enable a comparison to be made. Alteration in movements of both tongue and mandible can be checked and, probably more important, we shall find out which of those atypical behaviour patterns persist.

Posturing forward in speech is shown in both Class II, division 1 and Class II, division 2 type occlusions. Several patients are shown to illustrate the tongue behaviour in producing an ad-dental sigmatism. Two cases show an excessive activity of the tongue in multiple interdentalism. There is a comparison of two types of tongue behaviour in fraternal twins, both with an interdental lip. One of these twins illustrates well an asymmetry of tongue

movement which I feel certain is related to the persisting finger-sucking habit.

### CONCLUSION

In conclusion I would like to state that this is the beginning of a research project, and not the end. In view of the small numbers, the investigations carried out so far must be considered pilot investigations, and further work along these lines is proceeding.

I feel that a more complete assessment of the tongue behaviour in the wider field of speech, in addition to that shown in the act of swallowing, will give us increased information on the relative importance of the atypical behaviour patterns. It may also help us to clarify the diagnostic importance of the various types of lisp.

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### REFERENCES

- BALLARD, C. F. (1951), *Trans. Brit. Soc. Orthodont.*, 37.  
— (1955), *Dent. Practit.*, 6, 80.  
— (1956), *Trans. Europ. orthod. Soc.*, 44.  
— (1957), *Dent. Practit.*, 7, 269.  
BENEDIKTSSON, E. (1958), *Acta odont. scand.*, 15, 275.  
BERNSTEIN, M. (1954), *Amer. J. Orthodont.*, 40, 149.  
FRANK, B. (1955), *Ibid.*, 41, 571.  
FROESCHELS, E. (1937), *Stomatologia*, 35, 232.  
GWYNNE-EVANS, E., and TULLEY, W. J. (1955), *Trans. Brit. Soc. Orthodont.*, 159.  
HOPKIN, G. B., and MCEWEN, J. D. (1955), *Dent. Practit.*, 6, 123.  
— (1957), *Ibid.*, 7, 313.  
HOVELL, J. (1955), *Brit. dent. J.*, 98, 114.  
LEECH, H. L. (1958), *Dent. Practit.*, 9, 57.  
MORLEY, M. E. (1957), *The Development and Disorders of Speech in Childhood*. Edinburgh: Livingstone.  
RATHBONE, J. S. (1955), *Angle Orthodont.*, 25, 42.  
RIX, E. (1947), *Proc. Europ. orth. Soc.*, 24, 191.  
— (1953), *Dent. Rec.*, 73, 27.  
TEMPLIN, M. C. (1957), *Certain Language Skills in Children*. London: Oxford University Press.  
VAN THAL, J. H. (1935), *Proc. 2nd int. Cong. Phonetic Sci.*, 254.  
— (1954), *Speech*, 18, 24.

### DISCUSSION

Professor C. F. Ballard congratulated Mr. Blyth on his paper, the clear analysis of the cases, and the presentation.

Mr. Blyth had stated in his opening paragraph that it was generally accepted that dental irregularities were not a direct cause of sigmatism, and where the two were present in an individual some common cause must be found. His own experience about 5 or 6 years ago had, however, shown that this was not so, and Miss Bond had informed him that outside a small circle of speech therapists associated with orthodontists it was still not generally accepted that dental irregularities were not a direct cause of sigmatism. He thought that view was due to their belief, in some way or other, that the acquisition of correct articulation was the same process as the learning of skilled movement.

Those who studied orofacial behaviour did not believe that the patterns of activity that they saw were in the nature of learned skilled movement, because, in fact, they did not see them change. An individual had a typical morphology and pattern of activity which he would adapt for speech.

In that respect he would like to discuss the use of the word "maturation". Mr. Gwynne Evans and perhaps Mr. Rix would also agree that initially the fundamental mistake had been made of thinking in rather vague terms of maturation. It had been thought that the infant was born with certain patterns of activity, and that as part of its natural development those patterns were going to change to something fundamentally

different. He did not think, in fact, that such a view could be accepted to-day.

The changes that one did see, and about which Mr. Blyth had been talking, were in the nature of a modification. The word "maturation" could be used, but they were modifications which occurred in a very high proportion of the malocclusions that were seen over the age period from the time of the eruption of the incisor teeth through to about 11 years. There were no fundamental changes in tongue or lip behaviour in these cases, but very often open bites associated with tongue-thrusting over the period mentioned would close up without any orthodontic treatment being required.

Mr. Blyth's research work really originated from the general concept on the basis that people had characteristics of behaviour which they modified for speech, according to how they perceived the sounds of our language.

He thought one of the really significant points was that it had been shown that sigmatism was associated more with the Class II, division 1 malocclusion than with a low tongue position associated with high maxillary-mandibular plane angle, or with the postnormality of the dental base. While that required further research, to his mind it would indicate a reason for some of the adaptive behaviours that were seen. There was the necessary lip to tip of tongue contact to seal off the mouth, to produce a seal across the increase of overjet, which so disturbed lip and tongue behaviour that the individual, at least over the age period of 6 to 11 years, could not adapt



and produce sounds properly. The child learnt to do it, but it took time.

He would suggest, therefore, that a lot of these sigmatism were not associated with the endogenous tongue thrust at all, but with a habit activity. That would be consistent with their ideas.

Miss Bond had given a point which supported this view, which was that with some of the articulatory defects the majority of speech therapy training would not be an endeavour to get the individual to acquire skilled movement with lips and tongue but an attempt to cultivate the perception of what that required. In other words, the training was in the perception of sound so that the individual would modify his own behaviour quite subconsciously to produce the correct sound. He did not have to be taught to use his tongue and lips in any particular way, and in fact research was going on which suggested that in a speech therapist's attempt to teach an individual exactly how to produce a particular sound the effect would possibly be to render it even more difficult for that individual to learn to produce a sound correctly. That was the research in which Miss Bond, Mr. Blyth, and one or two others were interested at that moment.

With regard to the finger- and thumb-sucking, the degree of open bite and its significance in relation to improvement, he rather reluctantly agreed with Mr. Blyth. He thought that in the case of a very large open bite which would be asymmetrical because of the finger- and thumb-sucking, if the child in fact did persistently suck a finger or thumb it would for some reason or other indicate that the prognosis was likely to be poor. He was not prepared to give any explanation at that stage, because he thought it required investigation. It had been suggested that there might be an hereditary basis for finger- and thumb-sucking. That was not necessarily the only aspect of that relationship, and it certainly needed more research.

The posturing cases were very interesting; again this was an adaptive mechanism. It would seem necessary that at least for the production of English speech the front teeth should move up and down close to one another without there being any labio-lingual space. Whenever an individual, owing to an asymmetric jaw relationship, had a gap or labio-lingual space in relation to the upper incisor teeth, inevitably posturing downwards and/or forward to eliminate that space was noticeable. If an individual did posture in that way, there was a gap between the cheek teeth which might produce lateral sigmatism.

Why did some have lateral sigmatism and others not? Again it was possible that it was due to their auditory perception. They might not realize that they were lisping, and that was where the speech therapists came in. Again, if the overbite was eliminated the space was eliminated, as Mr. Blyth had pointed out, to a certain extent. The gap at least between the cheek teeth was eliminated, and the sigmatism could disappear.

He thought Mr. Blyth had pointed out the way for considerable and useful research which, using orthodontic concepts, would be of value to the speech therapy world.

Mr. J. R. E. Mills said that as he understood it the interdental sigmatism was the ordinary lisp with the "th" replacing the "s" sound. While this could be associated with an anterior open bite, it was sometimes seen with a mild increase in overjet and a complete overbite. Had Mr. Blyth any comments to make?

One of our problems was to differentiate the endogenous tongue thrust from one which was merely a habit. His own clinical impressions supported Mr. Blyth's statement that it associated with a multiple interdentalism. Mr. Blyth had said these patients had a lip-to-tongue resting posture with the teeth apart; could Mr. Blyth enlarge on this?

Miss L. M. Clinch, with regard to tongue thrust, said that it seemed to her that there must be two completely different types. Mr. Blyth had said that tongue thrust was reduced as the sucking habit was controlled. Could not the sucking habit produce an incisor open bite, and the tongue push through this space? If, however, the incisor overbite was corrected at the same time as the sucking habit was controlled the tongue could not bulge through the incisors. In other words, the tongue thrust could be secondary to the sucking habit.

While she realized that that was obviously not the endogenous type of tongue thrust, she would like to ask if Mr. Blyth would agree that there was a secondary tongue thrust which could actually occur as a result of the open bite caused by the sucking habit. It was her impression that this could happen, and she would have thought that the tongue thrust would not be associated with sigmatism in that case.

Mr. J. H. Hovell said he felt the ability to differentiate between an endogenous pattern of behaviour and a habit activity was all-important.

There were two things that one could take into account, the first being that an endogenous behaviour was always accompanied by a much more powerful circumoral contraction of the orbicularis oris muscle than in a habit activity. It was in such a case that difficulty was found in trying to examine a tongue thrust in the classical manner of parting the lips. The very powerful contraction of the circumoral muscles he thought, however, was associated with an endogenous tongue thrust. Secondly, a tongue thrust in a Class I or mild Class II dental base relationship was much more likely to be an endogenous one than was one occurring in a frank Class II dental base relationship. The latter was likely to be a habit pattern of behaviour as a result of forward positioning of the tongue, either to obtain a seal against the lower lip or to get contact with the upper incisor teeth. He therefore always taught, contrary to what many people said, that the case of the Class II, division 1 on a normal dental base relationship was the one with the poor prognosis. In these, one frequently found the endogenous behaviour which was not correctable and did not correct itself.

In connexion with the high Frankfort-mandibular angle, one was more likely to have an incompetent lip morphology with a post-normal dental base relationship, the upper incisors being less likely to be controlled by the lower lip. Had these points been checked in any way during the investigation?

Mrs. Jackson said she had been interested in the subject since her colleagues at Manchester said she had a sigmatism. She had tried, and failed, to eliminate it entirely from her speech and thought this was because she had an anterior open bite. It seemed that although an existing sigmatism might be minimized it could not be eliminated unless the open bite condition resolved. Spontaneous cure of a sigmatism only seemed to occur when the open bite and tongue-thrusting swallow was of a transient type, as in the mixed dentition before and during incisor eruption.

Mr. J. S. Beresford said that he did not think Mrs. Jackson needed to worry about where the lip and tongue went.

Mr. H. E. Wilson said it was known that discrepancies occurred between certain parts of the facial skeleton and soft tissues, and he sometimes suspected that what appeared to be endogenous tongue behaviours were, in fact, discrepancies between the size of the oral cavity and the size of the tongue. This was a subject rarely, if ever, discussed and would be very difficult to prove or disprove, but some children did appear to have very large tongues.

Mr. Blyth said that it was necessary to keep the patient under observation for a long time, but a proportion of the children would fail to return for one reason or another and it would be difficult to build up cine records of a sufficient number of children. Six or 12 months or even 2 years of observation and cine records before treatment would be most useful in deciding changes that occur in the oro-facial musculature due to maturation, or following treatment.

Professor C. F. Ballard said that Mr. Blyth had shown some low tongue positions in his X-ray slides. One way of checking, and in fact of answering, Mr. Wilson's query, was to note in those tongue-thrusting cases the position and posture of the tongue.

A tongue which had a thrusting behaviour, whether it was endogenous or not, dipped down.

In order for Mr. Wilson's suggestion to be sound, in all cases there would have to be found a tongue completely filling the oral cavity inside the mouth. This was found in some cases, and quite obviously it was a point for observation and investigation. It was interesting, however, that when the overjet was reduced, in many cases the tongue changed its resting posture.

Mr. W. J. Tulley said he was sure that this was the beginning of a most important work, because a "serial story" technique was the only way in which the problem was going to be understood. He thought too much was said too dogmatically and too early about the subject.

The Chairman said he was sure that the amount of discussion that the paper had stimulated was a measure of its success. He would ask Mr. Blyth to reply.

Mr. P. J. Blyth thanked Professor Hallett and Professor Ballard for their very kind remarks. He agreed that a great deal was yet to be done, and he, personally, would like to see Professor Ballard's remarks in print before replying to them.

With regard to Mr. Mills's point about ad-dental sigmatism, the points he himself had been trying to make were that the ad-dental sigmatism could be related to any occlusion and was not really necessarily related to an abnormal swallowing behaviour. He would still find it difficult to attempt to differentiate between the thrusts. In many of them he had made the attempt and recorded it in his diagnosis. It remained to be seen what happened.

When he had said that he was very suspicious of a lip-tongue contact with the teeth apart, he had meant with all the teeth apart, posterior teeth as well, and the sort of habit with the tongue resting through between all the teeth. He was suspicious of that type because he did not think the answer to it was known.

He would like to thank Miss Clinch for her remarks, and would agree most definitely that there were two types of tongue thrusts. With regard to the secondary type of tongue thrust he did not think it was necessarily the result of the habit. It would be difficult to say which came first.

He would like, also, to thank Mr. Hovell for his comments, and would agree that an attempt must be made

to differentiate between the swallows. He thought there were four or five points which had to be answered. First of all, what happened to the posterior teeth at the moment of swallowing? Were they apart or together? Also, what happened to the tongue, anteriorly? Did it thrust, or did it not?

Again, if the posterior teeth were apart, was there a very active anterior thrust, or was it just coming through to meet the lips? He would certainly like to assess the lip morphology, because if the lips were incompetent then they were going to have to contract in any case, normally, to effect a lip seal during the moment of the swallow. The amount of contraction needed for that would have therefore to be discounted. Was there an excess of contraction, then, to meet an anterior tongue thrust? Some incompetent lips of course did not contract at the moment of swallowing.

Further, one had to watch a child swallow dozens of times before getting the true picture of what that child's swallow was really like, and at that stage one could relate it to the occlusion, see what effect it was having, and whether it was perhaps a cause or, if associated with other factors, a result.

He was afraid he had not quite grasped the purport of Mrs. Jackson's remarks about the lip-tongue contact, which she had tried to eliminate. He would agree most certainly that there was an endogenous tongue thrusting with lip-tongue contact and interdental sigmatism which might be improved but which would not get better. He thought it was terribly difficult at this stage to try to differentiate between those types and other types. The association of the habit was something which would be helpful.

He would like to thank Mr. Wilson for his remarks. Professor Ballard had really answered his question.

With regard to Professor Ballard's point about the position and posture of the tongue, there were 106 cases where that low tongue position had been found. They were related to all occlusions: Class III; Class II, division 1; and Class II, division 2. He had checked on the number, and while he had no details with him he could state that they had been very nearly the same as the total group, with a slight increase in the Class II, division 1 cases. There had been one or two Class II, division 1 cases in which the tongue position had altered over the period of the orthodontic treatment. Almost all of the cases had been assessed on several X-rays and not just one. The tongue position had been found fairly constant, except in two or three cases in which it had altered and which were being followed up.

He would like to thank Mr. Tulley for his remarks. He was certain that it was correct that one could get a better answer by observing the continuity of the cases over a period of years. It had been with that idea in mind that filming of his patients had started two years ago. The film was not complete, the titles having been put on for this particular paper. The filming was going on continuously and some of the cases were approaching the stage at which they would be refilmed. When that stage was reached they would be in a position to compare the behaviour patterns. In exactly the same way, all cases with lips were being recorded, and an endeavour made to keep as full a note as possible of the behaviour patterns so that later on it would be possible to look back and get useful information from the total combination of the photographs, the recordings, and the notes.